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Aërial Photography an Aid to Mining

By E. G. Rydlun

MINING

Modern Methods at an Old Limestone Mine

By G. A. Morrison

HYDROMETALLURGY

The New England Cyanide Plant, in California

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Limber Up the Fountain Pen and Tell Us About It

EVERY WEEK your friends the editors try to reflect, in the columns of *E. & M. J.*, your purposes and to promote your interests. They can do this best if you will comment freely on what you read in its pages, either for publication or in a private letter. The editors are trying to do a good job. They will welcome suggestions as to how they can do an even better one.

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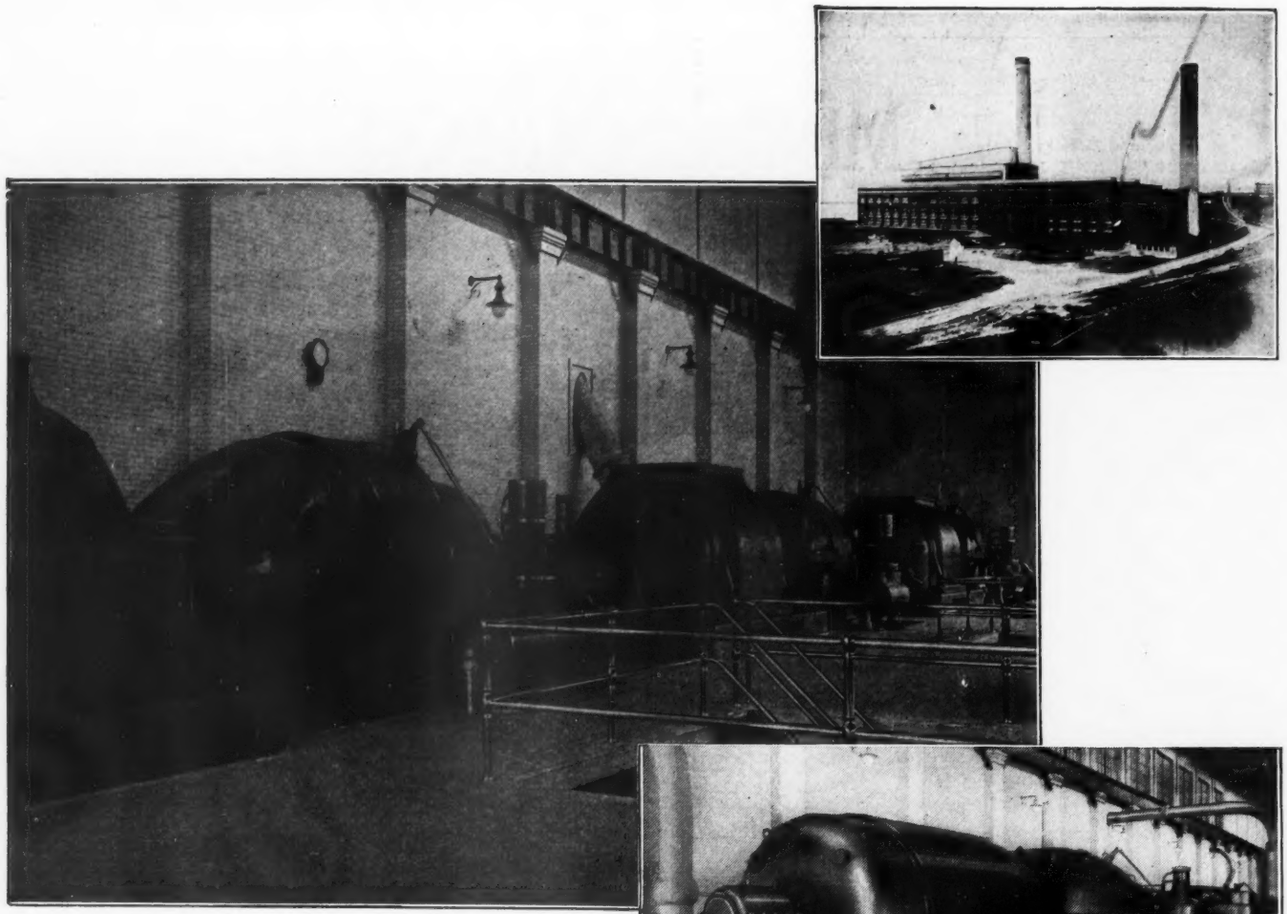

Steam Turbine Units

50,000 kw. in Allis-Chalmers Steam Turbine and Alternator Units are now installed in the station illustrated above.

In 1914 three 5,000 kw. units were installed, in 1919 a 10,000 kw. unit was added, while in 1922 another 10,000 kw. unit was placed in service.

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ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
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Editor

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Good News

ON AUGUST 2 the news items here reproduced "broke." Pessimists, all who "view with alarm," industrial Doubting Thomases, and those who are "selling short" or "talking short" on the prosperity of the American people should consider the significance and the effects on general business of the wide diffusion of money indicated by these announcements. They assure increased purchasing power and better living conditions, and reflect sound and forward-looking policies of management. General Electric announces that:

"The company paid $1,600,905 in supplementary compensation on July 30 to employees in its various plants and offices who have been in the employ of the company for five years or more. This sum, the largest ever distributed by the company in this form, represents 5 per cent of the earnings of employees for the six months ended June 30, 1928. The largest amount, $499,425, was paid to employees of the Schenectady works."

An Associated Press item from Lancaster, Pa., says:

"Nearly 25,000 employees of the Pennsylvania Railroad will receive increases of pay ranging from one cent an hour to $17 a month, effective August 16, Calvin W. Long, chairman of the executive board of the Pennsylvania System Fraternity, announced on August 1. He said the scale was approved at a conference with representatives of the railroad. Among those who benefited by the increases are trackmen, pumpers, cooks, blacksmiths, machinists, tinsmiths, welders, and carpenters."

When all leaders in American industry realize that high wages and employee participation in profits promote general prosperity, and when they act accordingly, the unemployment problem will be in fair way of solution. Millions now want to buy luxuries that can be provided and sold only when incomes are raised to a point beyond the "living wage." The people of the United States apparently have reached a stage of industrial development that assures provision of the necessaries of life for those willing and able to work with mind or hand. Successful "pursuit of happiness," their "inalienable right," demands for its satisfaction possession of the means to enjoy the refinements of civilization and the fruits of inventive genius, of art, and of engineering science and achievement. Not *how little will labor accept,* but *how much can be safely allotted to it,* is the most important problem before those responsible for industrial prosperity the world over. The corporations above mentioned, and many other important American industrial organizations, are pointing the way. The men directing their destinies have grasped the great truth that prosperity develops from the bottom up. Discovery of this fact, with its practical application, is America's greatest contribution, at this time, to the well-being of mankind.

The Mexican Situation

NEWSPAPER HEADLINES immediately following the assassination of president-elect Obregon made dire predictions for Mexico's future, but it is reassuring to find that later reports of the situation below the Rio Grande fail to indicate the likelihood of any political uprising in that country. In fact, though the crime is greatly to be deprecated, it is probable that many Mexicans feel that it ends the possibility that the reins of government might have been passed back and forth between Messrs. Calles and Obregon so long as they were able to hold them. Such a condition would be unhealthy in many respects, regardless of the personalities of the men themselves. President Calles, in an interview published in the New York *Herald Tribune,* states that he will not remain in office after his present term expires; that he wishes to retire to his dairy farm in peace. It now seems assured, therefore, that another candidate will be selected for this important office, and that one may reasonably expect political progress. Mr. Calles hopes that "we may some day take the place to which we are entitled in the society of civilized nations."

President Calles also speaks of the increasing friendship of the United States and Mexico, which he attributes largely to the good offices of Ambassador Morrow. As to the question of the safety of American capital in Mexico, he says, "Let me assure our good neighbors that American capital is absolutely safe here. Protection to American industries is assured by our laws." Further, he states, "I have been asked whether the religious disturbance is the chief cause of Mexico's confused political issues. My answer to that is that it is the only cause of disturbance, if one refers to the non-important armed groups that are in rebellion."

Doubtless the editor of America's best-known financial daily will rise up in wrath and say what he thinks about the self-assurance revealed in these statements, as is his wont; it is doubtless true that Mr. Calles has painted the picture in softer tones than those it really has and that American industrialists have had cause for complaint. Nevertheless, sympathy, friendship, and cooperation rather than censure should be extended to the Mexican people at this stage of their national existence. Our capable Ambassador has pointed the way. When kidnapings and murders occur in Mexico, we must not forget that similar news is not altogether infrequent from Chicago and Illinois, and that our Southern states harbor about two lynchings a month. When payroll robberies are reported by some company operating in the Mexican wilds, the thought might be in order that if heavily armored motor cars attended by from two to four men with drawn guns were used for the transportation of money, as is necessary in the streets of New York, such depredations in Mexico might be ended.

New Trade Associations Deserving of Support

ONE of the happy developments in business during the Hoover régime in the Department of Commerce has been the encouragement given to the compilation of business statistics for use in the intelligent direction of large and small industrial enterprises. This is an American trade practice of comparatively recent introduction, but so successful has it been that it promises to become increasingly important. Anything that makes it easier for business executives to give decisions based upon facts about their industries, rather than upon guesswork and misunderstanding of the position of their competitors, is worth having and improving. The trade association usually attempts to do that very thing.

The proposed association of lead producers and consumers has already been mentioned in these columns. A new association of the ingot metal trade was announced only last week, to collect and distribute data for the brass ingot producing industry and the secondary metal and alloy manufacturers and consumers. Both of these associations are in line with progressive thought and business practice. At the outset, no doubt, some companies that should be members will hold aloof until the value of the service is assured, thus putting a stumbling block in the way of quick and efficient organization. They should study the records of earlier institutes and associations, most of which have gradually increased their membership. Only in the last few weeks, one of the most important member companies of the Copper Institute, convinced of the value of the service, reversed its earlier policy of withholding a large part of the information asked by the institute. If a company is in doubt at the outset, it would appear desirable for it to give the new movement support, if it is well sponsored, thereby making the work of organization easier, the service more complete from the start, and the benefits derived greater. Later withdrawal may easily be arranged if membership is not considered of benefit.

Why *E. & M. J.* Favors Mr. Hoover for President

ENGINEERING AND MINING JOURNAL has frankly advocated the election of Mr. Hoover for President of the United States. In some quarters the advisability or good taste of this attitude has been questioned, but our position, we feel, is thoroughly justified.

Partisanship for a political party is not the reason for our enthusiasm. We would favor Mr. Hoover irrespective of his affiliations. As long ago as September, 1919, *Engineering and Mining Journal* formally proposed Mr. Hoover for the Presidency, at a time when he was identified, though in a non-partisan capacity, with a Democratic administration.

The mere fact that Mr. Hoover is a mining engineer is not in itself a controlling consideration. We recognize the force of the argument that the habits of thought and action of the engineer are different from those of the lawyer and the professional politician, as represented in most of our recent presidents; and that the selection of an eminent engineering executive would at least be an interesting experiment. But there are competent mining engineers—many of them—whom we would dislike to see in the great position of President of the United States. It is not so much engineers in general, but a particular engineer, that inspires our support.

At the same time, it is true that if Mr. Hoover were not an engineer *E. & M. J.* would not concern itself with the election. The circumstance that Mr. Hoover belongs in the same profession as that in which the majority of our readers are engaged undeniably has a bearing. As fellow engineers we know better than men in other walks of life the character and achievements of Mr. Hoover; we are better able to appraise his work than are others. A professional pride in the preferment of a fellow engineer is natural and understandable. But with all sincerity we can say that our primary motive in supporting Mr. Hoover is this: We believe that, with Mr. Hoover as President, the United States will have a government for the next four years in which the people in all walks and in all stations of life can feel a just and honest pride.

When Is Gypsum Properly Described as "Ground"?

PROVISIONS of the Fordney tariff admit crude gypsum free of duty, whereas "ground or calcined" gypsum is subject to a duty of $1.40 per ton. Through a recent interpretation of the United States customs officials, a change was made in the designation of a certain class of imported gypsum coming from Nova Scotia. This material, which hitherto had been coming in free, was reclassified as "ground," thereby becoming dutiable. American companies that operate the Nova Scotian mines and import the product learned of the matter in time to interpose objections and prevent the ruling from taking immediate effect. Hearings recently have been held to determine what action, if any, shall be taken.

With the intricacies of the legal phases of the issue engineers are not particularly concerned; but the question of the interpretation of the qualifying adjective is interesting in its technical aspects. The product in question is run-of-mine rock, loaded into cars by steam shovels, and passed through jaw or gyratory crushers set at 4 in. No sorting or screening operation of any kind is involved; and the purpose of the crushing is to facilitate the mechanics of efficient loading and unloading of the cargo steamers that carry the gypsum to the United States. Some slab-shaped pieces measure as much as 10 or 12 in. in one dimension. On the other hand, gypsum being comparatively soft, a certain amount of fine material is produced unavoidably.

The process of grinding involves comminution by means of attrition or abrasion; a typical example is the old process of grinding grain by means of millstones. With minerals it is accomplished with buhrstones, or with roller, tube, or ball mills of various types. These are distinguished from crushers, which effect size reduction by squeezing or pounding the material so as to crack it. The size of the resulting particles is not the only criterion by which to determine the designation of the product. Even though the average size of the particles be of the order of 10 mesh, if they be angular in shape, rather than worn or rounded, the product might not properly be classed as "ground."

A technical definition of a "crude" product is that it

requires additional treatment or processing before it is ready for utilization. Even if the fine portion of the Nova Scotian gypsum were screened out and shipped separately it would still be a crude material. It must be ground and calcined for the manufacture of plaster, blocks, and boards, the principal consuming uses. Even for use as a retarding ingredient in the manufacture of portland cement it must be ground by itself before it is mixed with other materials. It is difficult to stretch one's imagination to the point where the gypsum now being exported from Nova Scotia can be regarded as a "ground" or, indeed, as anything other than an essentially "crude" product.

Utah-Lead Fiasco Hurts Mining Industry

LEGITIMATE MINING in Utah has been given a hard jolt by the recent Utah-Lead stock-selling fiasco. Essentially the facts are these: The company owns or controls some property near Marysvale, Utah, on which are certain surface improvements, including a mill, and sundry mine workings. It may or may not have prospective value as a mine; but all agree that it has no great worth in the present state of development. The Salt Lake Stock and Mining Exchange, with the moral support of the Utah Securities Commission, the executive secretary of which gave the company a clean bill of health after a special visit to the property, allowed the shares to be listed on its board.

According to reports from trustworthy sources, 200,000 of the 500,000 outstanding shares were optioned to Eastern brokers at 50 cents per share, and the remainder were placed in escrow so that they could not be used to interfere with a share-kiting program. An intensive campaign of ballyhoo was launched in the East, and starting at $1 per share the price in two months was advanced to $7, on July 21. Thereafter it dropped to 50 cents in a period of three trading days. Nothing could be more obvious than that the "play" was purely artificial. This kind of episode is as old as it is sordid. It is the type of thing that hurts mining and helps put the industry in bad repute. The Salt Lake *Tribune* is to be commended for boldly criticizing the Stock Exchange and the Securities Commission.

If the listing committee of the Stock Exchange or the secretary of the Commission were unable to detect the plain earmarks of a stock-jobbing campaign, they appear to be the only responsible people connected with the mining industry of Utah who were so obtuse. One or two samples of the flamboyant literature regarding the project, that have come to our attention, are enough to put it under the gravest suspicion. It should be remembered the burden rests on the company to prove that it deserves listing, rather than on others to prove that it does not.

Of Utah it may be said that, in recent years, it has been comparatively free of notorious mine promotions. No good excuse appears for allowing the Utah-Lead débacle. If the Securities Commission or the Stock Exchange, either because of incompetence or for any other reason, does not more effectively protect the public, the leaders of the mining industry in the state ought to bring pressure to bear to correct a bad situation and to insure against a repetition of such a performance.

Progress in Steam Generation Practice

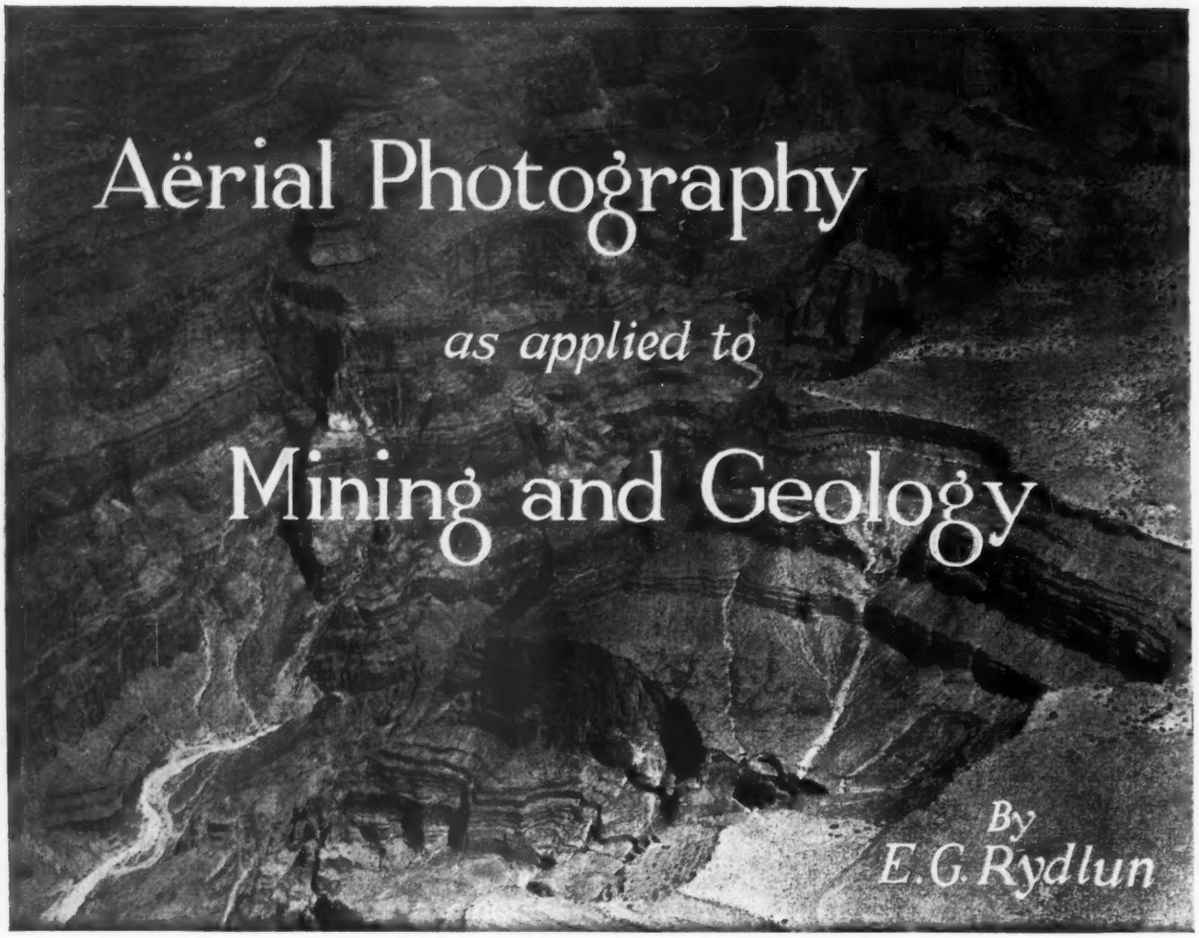
WHEN the term "steam generator" replaces the word "boiler" one will realize the many disadvantages under which the steam power unit has been laboring in competition with the newer types of internal-combustion engines. Large masses of water are boiled in the standard steam-raising unit, and the customary term is therefore apt. A change in practice is to be noted, however, and increasing interest is being shown in the raising of steam by more logical methods, and the efficient utilization of fuel by better provision for heat transfer. As with the tendency in recent years in evaporator practice, pressure circulation is replacing thermal circulation in steam generators. The plant becomes a closed-circuit unit, with all water and steam movements in one direction.

The traveling public is familiar with the smooth operation of steam-driven buses—a feature of the London street transportation system for the last twenty-five years or so. Detroit has recently followed suit, and the experiment has proved a complete success, with the Doble steam-power unit. The automobile similarly equipped, as those who have ridden in one will testify, offers advantages over the most highly developed gasoline-engine car. To a considerable extent the secret of success lies in the steam generator, which is radically different from the customary type of boiler. In a standard unit it consists essentially of a single tube, into which water is forced at one end and from which steam is delivered at the other, at a pressure of from 1,500 to 2,000 pounds. The success of the single-tube Doble steam generator, from the constructional as well as from the mechanical standpoint, is indicative of the immense opportunities in the application of welding. There are no joints, and the welds are stronger than the original steel tube.

By avoiding the water-storage type of boiler, and by generating steam in a small-bore tube, it is possible to obtain power within a few seconds of starting up the plant. The scaling problem has been satisfactorily solved. The speed of travel of water and vapor in the tube insures efficient heat transfer and the use of only sufficient water to provide the steam immediately needed. Features of a power unit equipped thus include the ease with which speed can be regulated and a promptness of acceleration that is unattainable by the use of any gear-driven unit.

Despite its mechanical and economic advantages, and occasional use of cars of this type, the steam automobile may not arrive for many years. In the meantime, however, the steam-driven bus is gaining headway, and the Doble principle is also being considered for heavy locomotive work by the Southern Pacific Railway Company. A single-tube generator of the type described apparently offers so many advantages over standard boiler practice in rail transportation that wide interest should be evinced in the outcome.

Water consumption in the past has been a drawback to the use of steam as motive power for transportation purposes. With significant economies in this and in other directions, transportation engineers will do well to follow closely the trends in steam-generation practice, as presaging changes of viewpoint in harmony with a logical alteration in a technique that has persisted with negligible basic improvement over a period of many years.



Aërial view of the Grand Canyon, Colorado

THE common methods of surveying may be summarized as triangulation, and precise leveling with amplification of topography by tachyometry, plane tabling, traversing, and chaining. It is a fundamental survey principle that no considerable area can be mapped without a control or skeleton whose positions are determined relatively to each other with an accuracy dependent upon the purpose of the survey.

The first step in building up the control is to measure a base line. This base line is usually several miles long. Upon this base line, and extending from it, a triangulation system covers the area to be mapped, and is usually extended to include other base lines, which serve to maintain its rigidity. The first, or primary, triangulation usually includes points about 30 miles from one another, and may be considered to define the distance between any two points to within 1/50,000 of the true length. The initial triangulation is then broken down and amplified with instruments with less precision until the area includes a fixed point every few miles. Aërial photographic surveying requires similar ground control.

Topographical methods of survey start from this control, and whether they consist of traversing, tachyometry, plane-tabling, or chaining, seldom escape errors of 1/1,000. Photogrammetry and phototopography are also of this order of precision.

Exploratory and reconnaissance work would benefit in many ways by the use of aërial photography. General reconnaissance has been carried on to a considerable extent in foreign lands as well as in America. Wide areas along the Mexican border have been photographed for the making of new maps and for the correction of existing maps. The new photographs of southern Arizona are said to show mountain ranges many miles away from their location on maps previously considered accurate. Such corrections are of great importance to the miner and geologist, for it is a well-mineralized district.

Types of Aërial Photographic Methods

In spite of the many types of cameras that are manufactured for aërial mapping, it is possible to classify the photographic types under three heads:

1. Verticals.
2. Composite verticals.
3. Obliques.

A vertical photograph is made when the camera axis is within a few degrees of the vertical position. Close approximations to a true vertical photograph can be made in a laboratory if the positions of three or more points appearing on the negative are known. The necessary transformation of the negative needed to accomplish this is not attempted except in certain stereoscopic methods of mapping. The vertical type of photograph is used in making mosaics as well as for maps and charts.

A composite vertical photograph is an assemblage of two or more aërial photographs made at one exposure by

a multiple-lens camera, and printed and mounted so that the assemblage of photographs forms the equivalent of a wide-angle photograph. This type of photograph results from the combination of oblique and vertical photographs after the obliques have been projected into the plane of the vertical photograph by a transforming printer. Such a printer enables photographic projections to be made when the image and the object planes are inclined to one another. The composite vertical type of photograph is represented by the three- and four-lens photographs made by the Army Air Service mapping cameras and is extensively used in map constrution.

An oblique photograph is made with the optical axis of the camera intentionally inclined to the vertical. The amount of this inclination depends on the purpose for which the photograph is to be used. Oblique photographs are used in stereoscopic plotting machines, such as the Hugershoff Autocartograph and the Zeiss stereoplanigraph. They are also used by the Topographical Survey of Canada in the compilation of maps in the relatively flat areas of that country. This type of photograph is also used in the United States in cameras of the multi-lens type, but in this case the oblique photograph is transformed before use and becomes a vertical photograph in fact.

A point which should be noted is that the oblique photographs can be taken on many days when it is impossible to take vertical pictures. For this reason less time is wasted waiting for favorable weather. This is because vertical photography must be done from high altitudes and requires as a rule perfectly clear skies. On the other hand, oblique photography is not interfered with by occasional clouds, provided the latter are not lower than 3,000 feet.

As an interesting example of oblique photography, the Oiseau and Cross Lake topographical sheets of the Topographical Survey of Canada may be cited. These sheets cover an area of approximately 8,500 square miles and include part of the Red Lake mining district, which is now attracting so much attention. The area covered was photographed by one crew in exactly eleven hours and thirty-four minutes out of a total flying time of thirty-four hours and thirty-two minutes. This latter, however, represents a large part of the working season. It was estimated that it would have taken one ground party fully ten seasons to map the same area.

Ground control is needed for insuring correctness of geographical position and maintaining accuracy in scale, as in other mapping undertakings. However, the use of oblique photographs has been proved of great convenience, because they admit of considerable latitude in the spacing of ground control points. This is fortunate, for ground surveys are limited to single-line traverses which are run by transit and stadia along river courses and invariably come at wide intervals. For the best results, parallel lines of traverses should not exceed 50 miles nor be less than 25 miles. Astronomical stations are located at intervals of from 50 to 100 miles and are connected with the traverses which are run in closed circuits. A probable error in locating these stations is less than 250 ft., which has been found to be consistent with the accuracy of the traverses. No higher degree of precision is attempted, for on the scale of the published map such an error would amount to only one one-hundredth of an inch and is therefore scarcely discernible.

An advantage is derived from doing the photographic work first and executing the ground control afterward. This in a measure reverses the traditional practice in surveying. The photographs not only enable the surveyors to select the most suitable locations for control points, but are of assistance in planning the work, transporting supplies, and locating camp sites, thus expediting the ground survey work.

Stereoscopic Methods

By means of the stereoscope, the map compiler may take advantage of the great exactness with which a photographic image is registered on the negative. This enables the actual drawing of the contours from the plastic image. Stereoscopic methods have taken many forms owing to the various types of photographs used, or to the character of the ground control demanded, and all but one of these have been developed abroad.

The Brock method, as utilized by the firm of Brock & Weymouth, Philadelphia, is typical and demands that four points, whose differences of elevation are known, appear on each plate. Elevations are more rapidly obtained when the necessary measurements on the photographic plates are made stereoscopically. This method demands that the two overlapping plates of the stereoscopic pair be replaced in exactly the same position that they occupied at the moment of exposure and that they then be reprojected into a horizontal plane. This process can be used when three, four, or more points appear in the plates when the vertical and horizontal co-ordinates are known. The information obtained, together with that provided by the plate itself, is sufficient to determine the tilt of the plate at the moment of exposure. It is then possible to reproject the image into the horizontal plane and thus eliminate displacements due to tilt. The process of stereoscopically obtaining the elevation of points from such a horizontalized pair of plates is comparatively simple, and can be accomplished by the Brock & Weymouth stereoscopes as well as other similar instruments designed for that purpose.

Formulas Used in the Interpretation of Aërial Photographs

Let s = scale expressed as representative fraction.
h = height or altitude.
f = focal length.
W = width of ground area covered by photograph.
w = width of plate.
L = length of ground area covered by photograph.
l = length of plate.
v = speed of airplane in feet per second.
t = time interval in seconds between exposures.

Then $s = \frac{f}{h}$

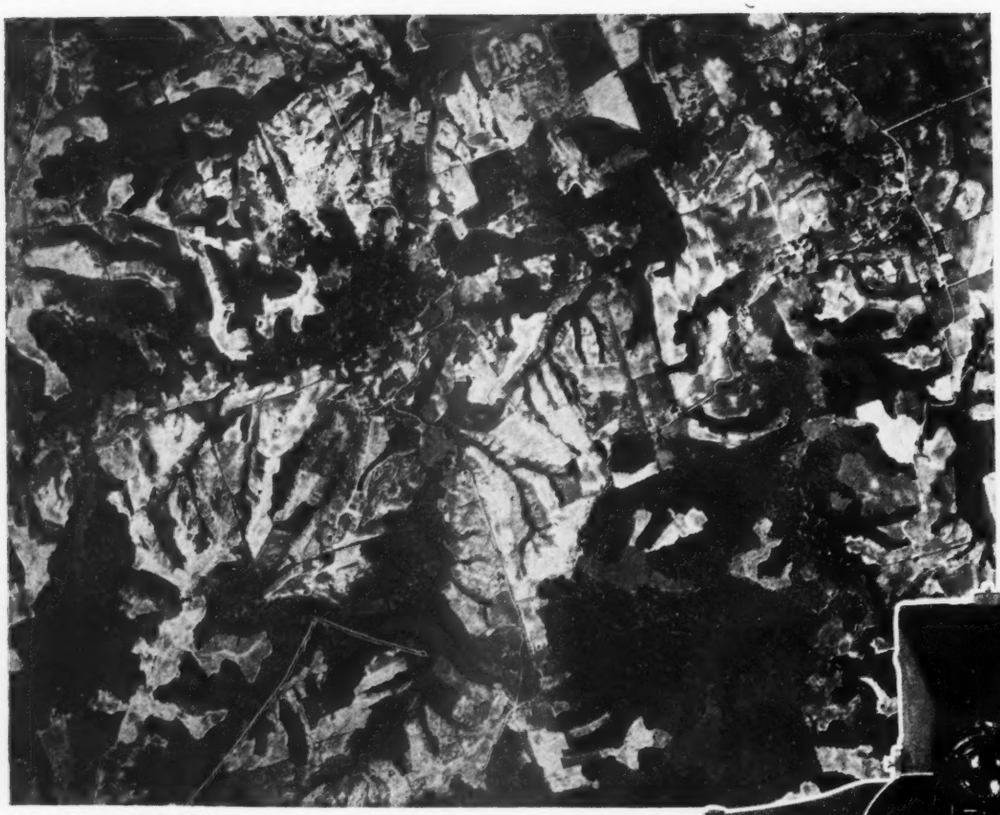
$$W = \frac{h}{f} \times w$$

$$L = \frac{h}{f} \times l$$

$$t = \frac{(100\ \% - \%\ \text{overlap})\ W}{v}$$

$$h = \frac{f}{s}$$

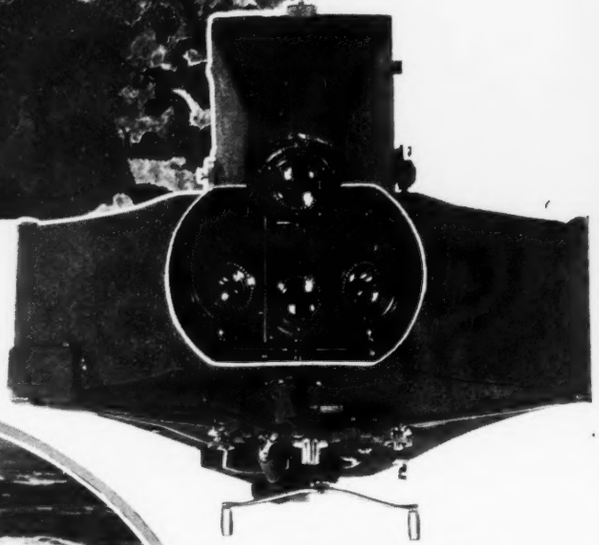
Note—The same units of measurements must be used consistently. If W is in feet, then h, f, and w must be

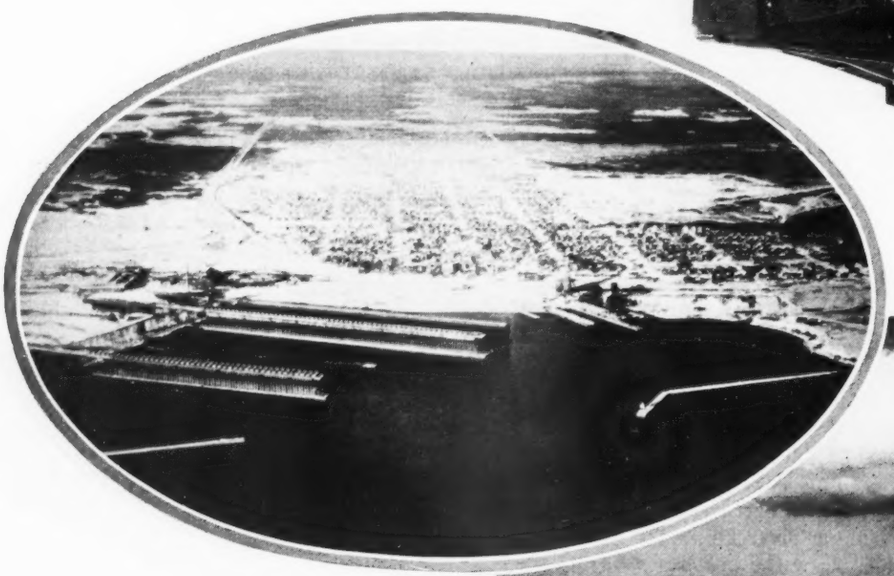


At left, aërial photograph showing a partly wooded area with typical Appalachian Mountain relief, from an altitude of 15,000 feet

Photo courtesy Fairchild

At right, multi-lens camera for taking several views at various angles simultaneously



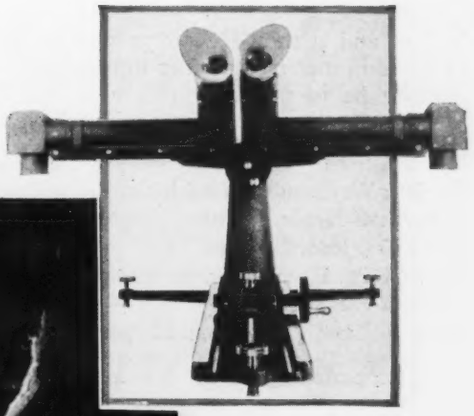


Below, Mount Shasta, California. The volcanic cone is clearly defined

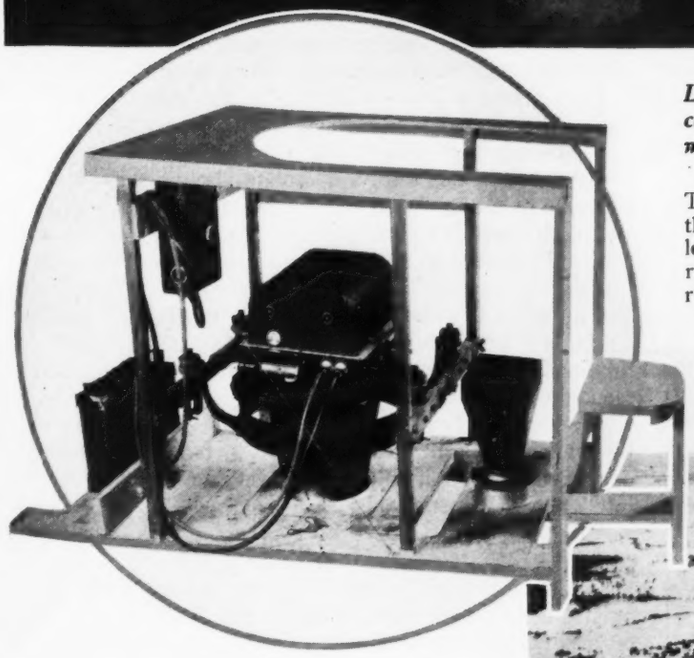
Above, dock facilities at the head of Lake Superior

With a down grade from the Mesabi Iron Range to the Lakes, it is natural that Duluth should be the principal shipping point for the millions of tons of ore mined.

Right, a magnifying stereoscope by means of which photographic details in relief may be clearly discerned and interpreted



At left, various depths of water are easily discerned from the air by the color, and the gradations are recorded in panchromatic plates



Left, mock-up mount of the K-3 (single lens) camera, showing arrangement in a cock pit with a vertical view finder, storage battery, and intervalometer

The film is wound at regulated intervals so that the photographer's time is chiefly occupied by leveling the camera, which is accomplished readily by means of the specially designed ring-mount.

Photos courtesy of the Army Air Corps.

Right, the meandering Mississippi River as seen during high water in May, 1927

in feet and v should be expressed in feet per second. If W is in meters the other dimensions involved should likewise be in meters.

Following is a list of companies which have developed stereoscopic methods:

Brock & Weymouth, Philadelphia, Pa.
Hugershoff-Heyde, Dresden, Germany.
Carl Zeiss, Jena, Germany.
Henry Wild, Heersbrugg, Switzerland.
Nistri, Rome, Italy.
Georz-Boykow, Amsterdam, Holland.

Determination of Topographic Features

Swamps, parts of everglades, partly submerged land forms, deltas, and beaches can now be studied as a result of the perfection of aërial photography. Correct representation of certain drainage systems was difficult to obtain until photographs showed them pictorially, the intricate drainage of the Atlantic coast marshes affording many illustrations. Typical of these are the marshes along the Pamunkey River, in Virginia, which were never accurately shown until photographed from the air.

Not only can the exposed portions of deltas and beaches be photographed; but the underwater portions, such as shoals and terraces, tidal deltas, and many other submerged coastal forms can be clearly shown. The question of whether the Atlantic Coastal plane of the United States is rising, sinking, or stationary is open to conjecture. To some extent the success in photographing tidal deltas, shoals, terraces, and other natural features will open a new physiographical avenue of research; and a possibility of solving some of the vexing problems of the earth's history is thus opened.

Meandering streams lend themselves admirably to aërial photography. Related physiographical and geological features such as abandoned meanders and ox-bow lakes have hitherto been illustrated on expensively constructed maps. In many instances wooded meanders, long ago abandoned by the stream that formed them, loom up only a little less conspicuously than those streams whose beds have been recently abandoned. This is, of course, attributable to the slight difference in texture or shade of the sand, constituting the bed of the abandoned meander. The camera image permanently records this contrast.

Mountain peaks in the midst of impenetrable country, or precipitous canyon walls, and volcanic craters, cannot be readily seen from the ground without undue effort or risk. From an airplane, however, the detailed features of such a typical and famous volcano as Vesuvius have first been revealed to many. Eskers, terminal morains, and other glacial formations, including chains of lakes, are difficult to follow. This is particularly true if the lakes are as interlocking as in the Canadian province of Ontario near the point of the Manitoba and United States border. This area was photographed by aërial methods by the Air Corps in 1925 to settle a controversy over power development.

The Alaskan Mapping Expedition

The innovation of mapping Alaska from the air, begun by the Naval Air Service in 1926, was a success beyond expectation. This expanse of land, water and ice, whose interior is little known, has great potential mineral wealth. More than 25,000 square miles of the southernmost tip of Alaska was mapped in one season on behalf of the departments of the Interior, Navy, and Agriculture. Such a mapping project executed by the usual methods would have required ten seasons.

Copper Prospecting in South Africa

An application of aërial photography to mining and prospecting in the potential copper-mining district adjoining Katanga proved very profitable. Reconnaissance and development work on a tract of land comprising 52,000 square miles in Rhodesia, directly south of Katanga, had proved too much of a task by the standard methods. Previous field work showed that the deposits of copper carbonate ore are interbedded with stratified rock. Erosion has worn away most of the anticlines, leaving the largest deposits of ore occupying synclines. Thus the outcrops extend in wide curves, and they are naturally conspicuous by virtue of being denuded semicircular areas of rock. Since there are openings in the jungle from causes other than those produced by the salts of copper, prospectors have been known to cross and recross such belts without suspecting the presence of ore. This is because the man on foot cannot readily discern the mineralized outcrop, since the far-flung curve of the syncline is often invisible to him. Although reconnaissance from the air seems suitable for an area as large as this, it must be admitted that the smaller outcrops might be unnoticed. However, in prospecting on such a scale, it is the large orebodies which are sought.

The object in using the airplane method of prospecting was to locate and peg all of the large and supposedly valuable deposits of ore. It was important that this be done within the period of the remaining three years of the original concession period. Had this work been done by the usual method, more than one hundred years would have been required for one reconnaissance party to complete it. Ordinarily such a party consists of a geologist, an engineer, and a few natives. On the other hand, the use of the airplane and camera required only 60 days.

Following the preliminary work, flights were made along parallel lines until a complete photographic picture of the whole concession had been made. Any area that revealed favorable geological criteria was revisited and again photographed both vertically and obliquely. After finding the favorable areas, it was possible to carry men and supplies to salient points where emergency landing fields had been located. In that way a minimum of time was lost in pegging the mineralized zones. The trenching and drilling followed. When the actual mining and milling begins, a complete photographic map will be available. Mill sites, power sites, roads, and centers of native population will then be known or at least can be intelligently investigated.

An Application to Oil Geology

Aërial photography has long been known to oil geologists, being especially useful in the preliminary work on a new area thought to be favorable. With the aërial photographs the field geologist verifies his judgment by using the stereoscope upon two adjoining prints. This instrument will enable him to distinguish such surface conditions as anticlines and synclines, so that the drilling may take place under the most favorable ground indications. Although the aërial photography and reconnaissance does not do away entirely with the ground work, this modern method simplifies such work considerably.

A summary of an oil-survey project in Venezuela indicates that costs might vary from $65 to $100 per square mile, dependent upon various factors such as location, kind of terrain, and availability of airships and pilots. The time saved by aërial photographic co-operation in prospecting was estimated as 90 per cent. A representative of the Pan American Petroleum Company further substantiated these desirabilities by the following: "The map obtained from the photographs is of such superior accuracy that, combined with the lower cost and the saving of time, it leaves no room in our minds for doubt as to the advantage of this method of survey."

placed at $50 per square mile. This cost will be much greater in certain areas, owing to the time it takes to work in swampy areas, over impassable roads in desert country and the like.

The saving by the use of aërial photographs is therefore about $35 per square mile. The saving to the government on this project alone amounts to approximately $400,000.

Besides this the time saved was between 50 and 60 per cent. Instead of spending weeks on one small area, as topographers often do, this work was done largely in the office. It is significant that the federal government considered the maps of superior accuracy in many cases.

Miscellaneous Cost Data

Survey	Area, Square Miles	Flying Time, Hours	Size Plate, Inches	Focal Length, Inches	Height, Feet	Scale of Photo 1:	Scale of Map 1:	Cost Per Square Mile	Cost Per Flying Hour
Nile, 1922	1,700	81	5 x 3¼	5	14,000	28,000	.....	$7.20	$97.60
India (Agra)	540	48	5 x 3¼	8¼	13,000	18,000	63,360	11.50	101.25
Army Air Service	.....	..	7 x 9	10	10,000	10,000	.....	10.00	100.00
Private company	.....	..	.....	...	.....	.....	21,120	40.00	60.00
Private	55,408	12	.....	...	12,000	.....	.....	5.00	.....
Private	3,500	4	.....	...	6,000	.....	.....	78.75	.....
Hugershoff	46.5	..	5 x 7	6½	3,280	.....	10,000	18.25	.....
Cranz (oblique)	46.5	..	5 x 7	6½	6,560	.....	25,000	10.50	.....
Tennessee River, 1921–22	675	28	7 x 8¼	10	12,500	15,000	20,000	60.00	145.00

An aërial photographic mapping project carried out by the U. S. Air Service in 1924 in behalf of the U. S. Geological Survey gives an insight into comparative costs. The area comprised 11,500 square miles, a region larger by one-third than the State of New Jersey. In laying out this work, quadrangles 7½ minutes in latitude and longitude were used as units for mapping. There were 143 such quadrangles, each having an area of 65 square miles. Collaborating with these two government departments was the Texas State Board of Water Engineers. The previous work on this sector was done in 1883 and 1886 by the U. S. Geological Survey and when compared to military maps and a Rand-McNally product all were found at variance.

Cost Data on U. S. Air Service Survey

Total number of miles covered	11,550
Average number of square miles per hour	100
Average number of square miles per day	500
Greatest number of square miles per day	1,600
Least number of square miles per day	225
Total time, hours	115
Number of days of actual photography	23
Longest time in one day, hours	7½
Total gasoline consumed, gallons	2,301
Total oil consumed, quarts	625
Number of rolls of film	17
Number of feet of film	6,460
Number of feet of film lost	175
Number of exposures	3,196
Cost of chemicals—Developing 17 rolls and making 1 print each, including ice	$500
Personal expenses	$125
Overhaul of motors used	$412
Depreciation of ship, estimated	$500
Cost of gasoline at 25c. per gallon	$575
Cost of oil at 35c. per quart	$219
Total for 11,550 square miles	$2,331
Average cost per square mile	$0.21
Cost of paper, drafting work, field control and topographical work per square mile	$15.00
Total cost per square mile with exception of the salaries of the pilots, observer, and men in the photo section	$15.21

Under the previous method of topographic mapping based on preceding work done in Texas the cost is

This is partly explained by the fact that much of the country is practically inaccessible for ordinary surveying parties.

Conclusion

It is my belief that the most practical and feasible solution in the mapping of large areas is by aërial photography. In the proposed mapping of the United States by the Geological Survey, most of the area still remains unmapped. It has been satisfactorily demonstrated that a combination of standard methods of survey with those of aërial photography is practicable. Such areas as desert, mountains, and marshes may some day be mapped by the method herein suggested, with a land party furnishing only the necessary control points. It is estimated that six airships, flying an average of eight hours a week for eight years, could map the entire United States; whereas Congress allowed forty years for mapping by the old system. The perfection of color photography would contribute still another element toward successful mapping. One can scarcely predict the ultimate, and cartography may again become an art such as the map makers of the fifteenth and sixteenth centuries considered it.

Insulated Mine-Car Couplings Make Explosives Haulage Safer

IN U. S. BUREAU OF MINES Serial No. 2868, F. E. Nash and C. W. Owings call attention to the use of insulated mine-car couplings on cars used for hauling explosives—to prevent an electric current passing from a mine locomotive to a car or between cars joined by such a coupling. On man trips the insulated coupling serves the purpose of guarding the men against shock. Fiber or wood is used as the insulating medium. A coupling may consist of two steel parts separated by a piece of fiber board; another coupling consists of a piece of wood to which are bolted the metal parts of the coupling. It is stated that a bad bond or the use of too much motor sand occasionally causes a poor ground and charges the locomotive frame. An electric current may then pass through the couplings and drawbars.

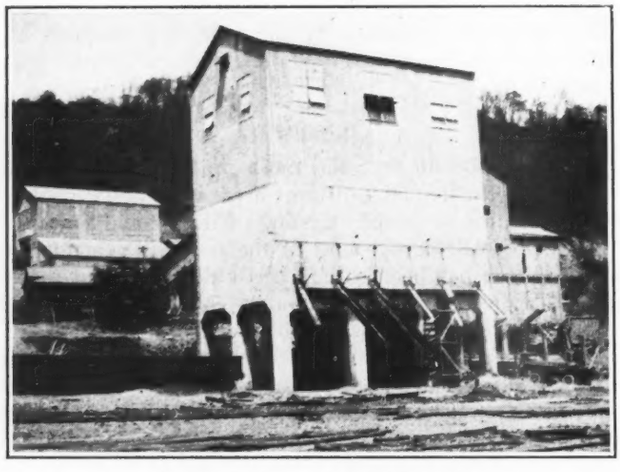
Modern Methods in the Country's Oldest Limestone Mine

By GEORGE A. MORRISON

Mining Engineer, West Penn Cement Company, West Winfield, Pa.

INTERESTING WORK is being carried on in the mining of limestone by the West Penn Cement Company, which owns extensive holdings at West Winfield, Butler County, Pa. The limestone is destined primarily for the cement industry, but a portion is also used for roadstone.

The property lies among the rough, rolling hills of a steeply inclined ridge which runs southeasterly between the deep-cut stream bottoms of Long Run to the east, and Rough Run to the southwest. An important uplift with northeasterly axis crosses the property and present stream beds. Flat-lying beds about 20 ft. thick were quarried until the overburden became so excessive that the handling was too expensive. To obviate this, underground methods were adopted. Furthermore, many overlying strata carry workable coal measures, and gas wells dot the rugged surface. That both of these resources be preserved was imperative. Extensive drilling has proved a large deposit of excellent grade limestone, known as the Vanport Series, which lies almost parallel to the surface. This stone averages 22 to 25 ft. thick and lies conformably on shale beds. The overlying strata are of shale, repeating with alternating layers of coal and sandstone, making thus a total of 200 or 300 ft. of covering over the limestone.



General view of crushing plant

The deposit is opened by driving tunnels, or entries, 25 ft. wide, into the mountain and turning off rooms alternately to right and left on 60-ft. centers. These rooms are 35 ft. wide and the pillars 25 ft. in width. As tonnage is required these rooms are extended.

All drilling is done by hammer drills mounted on tripods, and a method of breast stoping is employed. The 35-ft. face of the room is first attacked by putting in a "V" cut of eight holes—four on a side. These are carefully drilled at right angles. The top holes are drilled upward at an angle of 45 deg.; the second row, upward at 20 deg.; the third, very nearly horizontal. The fourth, or lowest set, point down at an angle of 25 deg. Two dynamite boxes and a long steel serve admirably to lay out the angle of the two drill holes constituting a set. With this fanning of holes in the vertical plane, a spread of about 14 ft. is reached, and as these eight holes are fired as a "round," a vertical height of 17 ft. of limestone is broken. Well-developed partings at both roof and floor result in an unusually clean break. The blasting of this "V" cut advances its point about 9 ft., and 80 tons of broken stone results.

A machine is next set up within the niche just blasted and four holes are drilled into each resultant sidewall. The vertical arrangement of the "V" cut is retained, but in this instance it connects with a double set of holes drilled into the original face and meeting at right angles. These two sets of "V" holes are now fired, and the resulting opening squares up to approximately 22 ft. Machines are then again set up in the new opening. Holes are drilled in the sidewalls to meet, in this instance, "rib" holes that have been drilled from the original face along the pillars on either side of the room. This completes the extension of the room until another cycle is started. Then the "V" cut is put in the new face of the room, and the work proceeds as before. By this method a

A Thew shovel, one of the older models, loading stone

driller and helper, alternating in two different rooms, drill off a full face in three shifts—a machine-drill duty of 150 tons per shift.

After three such combinations of drilling, the face will have been advanced from 27 to 30 ft. Then a stoper drill is moved in. The drilling is done from the top of the pile of broken stone, and 3-ft. holes are cut into the roof on 6-ft. centers. In this operation about 40 holes are drilled, and subsequently all are blasted together. The room is then 20 ft. high, and the roof resulting is scaled from the top of the stone pile.

About 1,600 tons of broken stone result from this cycle of mounted and stoper drilling. The total expenditure of dynamite is 0.5 lb. per ton.

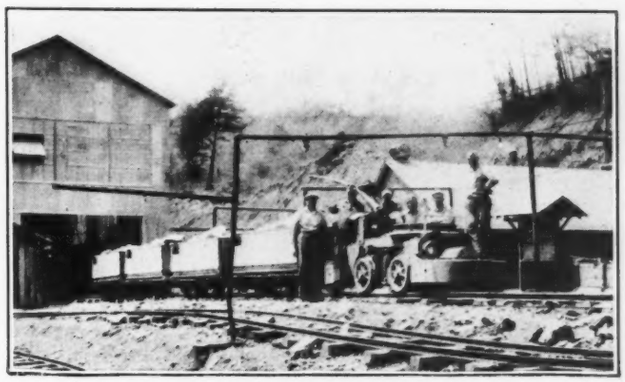
Electric Shovel Used for Loading

When such a pile of stone is broken, an electric shovel, mounted on caterpillars and supplied with a 1-yd. dipper, is moved in and finishes loading in three or four days. The standard shovel employed is the Marion Type 7, with a 12-ft. 6-in. boom and a 9-ft. dipper-stick, and is full revolving. It loads into 135-cu.ft. steel cars mounted on roller bearings. These cars hold about seven tons as

One of the rooms in the mine. The curving layer near the top is the shell layer, marking the upper limit of the 20-ft. limestone bed

loaded by the shovel, and the rooms are double-tracked for a distance back of the shovel. Two horses serve each shovel, hauling about 400 ft. to a siding. Here an electric locomotive picks up the assembled trains of six to eight cars for delivery at the crushing plant. Loading costs by shovel are from 5 to 7c. per ton.

The main haulage tracks are of 40-lb. rails laid on 5x6-in. x 5-ft. oak ties which are placed on 2-ft. centers and well ballasted. The gage is 36 in., and No. 3 frogs are used throughout. Room tracks are of 30-lb. rails with



Electric locomotive hauling loaded cars to top of crushing plant

4x5-in. x 5-ft. ties at 3-ft. centers, and are made up in 10-, 15-, 20- and 30-ft. sections. All track in places where a blast might strike it is removed before shooting begins, and it is replaced afterward by merely bolting the sections together.

No ballast is used in the rooms, inasmuch as the shale floor is smooth and level. Two Ironton electric seven-ton locomotives with gathering reels are used, and at present serve the whole mine. A 150-kw. motor-generator set serves the haulage and shovels, as well as a small fan and lighting purposes. The switchboard is of latest design, and is automatically controlled.

Steel cars of special local design so that the sides fit the guides on the rotary car-dumper at the crushing plant are used; they are equipped with full band brakes on all four wheels.

Ventilation is natural and good air is maintained throughout the mine even with heavy blasting—sometimes on two shifts. The large openings and high rooms tend to dissipate the dynamite fumes quickly. There is one face, however, in process of driving, which is about 3,000 ft. in from the entrance, and which is being ventilated by a small fan.

Mine Conditions Are Excellent

The openings are wide—entries and rooms are 25 and 35 ft. respectively—with roofs 19 to 22 ft. above the floor, and no timbering is used. There is no water problem, and the floors lie smooth and even. In drilling holes toward the roof, special effort is made to keep from drilling into top layers of two or three feet of the limestone deposit where a well-defined parting exists. This parting is along what is known as the "shell" and is the more compressed and siliceous layer of the deposit. These layers constitute the roof of the workings and are scaled while driving, and they seldom need any attention afterward.

Occasionally the men on high benches go through the haulageways to examine and take down any pieces of the shell that may have become loose. Thus the top of the deposit is left as a beam to span worked-out areas. This beam rests upon pillars of stone which are ample to support the overburden, which consists mostly of weak measures. Accidents are rare, and no injury whatever has occurred from falling pieces of rock for more than a year. No serious or fatal accident has ever occurred from this cause.

Hammer drills of the Waugh No. 7 type are used with 1¼-in. round drill steel, which is lugged. Gages are

shown in the table which follows, with the length, in feet:

Gages of Drill Steel

Length in feet	Gage in inches
2	2½
4	2⅜
6	2¼
8	2⅛
10	2
12	1⅞
13	1¾
14	1⅝

The starter is a cross bit with the hole on the side behind the up-setted end, but all other bits are a special double-chisel type with a very large hole. A set of six pieces of steel will drill three to four holes 12 ft. deep. The type of drills used will average 5 in. per minute drilling with these bits. All steel is sharpened on the sharpener and heated on a coal forge.

The loaded cars delivered by the locomotive in trains of six to eight cars are set on the "loaded car" track at the crushing plant. A car puller, arranged to haul standing cars in train lots over the scales, delivers to the revolving car dumper, operated by compressed air. Cars are dumped into the crusher without uncoupling, and the empties drift down the empty-car track. Here they are picked up by the locomotive, which, in the meantime, has gone around the crusher building by a by-pass track. The locomotive returns the empty cars to the mine through an entrance other than that from which the loaded ones come, thereby completing a circular path called the belt line. Over this, trains are moving always in but one direction.

The stone dumped by the car dumper goes directly into a 30-in. gyratory crusher set at 4-in. opening and driven by a 125-hp. motor. The product from this goes over a live-roll grizzly which has 2¾-in. openings. From here the oversize goes by elevator to a 10-in. gyratory crusher set at 2-in. openings. This product joins the undersize from the grizzly and is delivered by a 24-in. conveyor to the screen room. Here a revolving screen—72 in. in diameter by 26 ft. long, jacketed for 15 ft. of its length—is mounted directly over twelve concrete bins. The ten products of this screen, after proper mixing and blending, fall into these bins, which hold about 150 tons each. The bins feed into railway cars on the double tracks immediately below.

Delivery of the conveying belt from the crushers is arranged so that material destined for the cement plant can be sent directly into bins without screening. Screened products are used for the road material and concrete aggregate.

Some loading is done by hand labor, a man averaging twenty tons per shift. Additional power shovels will be put to work soon. Under existing conditions an average of sixteen tons per man-shift—including crushing-labor—is obtained; when all stone is loaded by power shovels, this will be increased to twenty tons.

This property is the oldest limestone mine in the United States. It was opened up in the early 'nineties and has been operated continuously since. The product enjoys an enviable reputation gained through years of careful study of stone requirements for the trade. It is free from soil contamination and is reported excellent for cement manufacture, owing to its purity and uniform analysis. The operation is gradually being brought up to 2,500 tons per day, about one-third of which will be available for sale in the market as commercial stone.

Treatment of Copper-Smelter Flue Dust

THE U. S. Bureau of Mines has been carrying on an investigation of the treatment of copper-smelter flue dusts, and recently issued an extensive bulletin on the subject (Reports of Investigations, Serial No. 2,871). The conclusions follow:

1. The analyses and physical examinations of the flue dusts indicate that a part of the copper sulphide minerals—chalcocite, chalycopyrite, and bornite—present in the original ore feed have been converted into a water or acid-soluble condition, the chalcocite being more readily oxidized or sulphatized than the other copper sulphide minerals.

2. The treatment of raw copper-smelter flue dusts by leaching with any of the ordinary solvents—water, dilute sulphuric acid, or acid ferric sulphate—does not, except possibly in a few instances, appear encouraging. Most of the raw dusts contain too high a percentage of the insoluble or difficultly soluble copper sulphides.

3. By careful roasting of the raw flue dusts at a temperature not to exceed 600 to 625 deg. C., it is possible to obtain up to 80 per cent of the copper in a water-soluble form, and from 90 to 98 per cent will be soluble in a 4 to 6 per cent sulphuric acid solution. Acid ferric sulphate is somewhat more efficient than the sulphuric acid alone, but the cost would be greater because of the expense of regenerating the ferric sulphate, unless some process were used in which sulphuric acid and ferric sulphate were formed at the same time. Should it be desired to avoid the difficulties caused by roasting and yet in general get a better extraction of the copper when leaching the flue dust with ordinary solvents, the amount of roasting now given in the flue will have to be increased.

4. A partial survey of the literature has been made for methods of handling the flue dust dry—by briquetting, agglomerating, sintering, and nodulizing. Some preliminary tests were made and good briquets obtained by briquetting with cement, lime, and lime plus slime.

Conditioning Reagents in Flotation of High-Silica Bauxite

EXPERIMENTS in the flotation of high-silica bauxite, being conducted by the U. S. Bureau of Mines, at its Southern Experiment Station, Tuscaloosa, Ala., have indicated that sodium sulphide is the most effective reagent for conditioning the pulp. The substitution of other causticizing reagents in place of sodium sulphide usually results in a greatly decreased recovery during flotation. It is significant, however, that sodium hydroxide and sodium carbonate, when used as conditioning reagents, will cause a considerable proportion of the bauxite minerals to float. Sodium carbonate is somewhat more effective than sodium hydroxide, but under the best conditions obtainable so far, neither of these reagents will yield a recovery exceeding two-thirds of that obtained by using sodium sulphide.

In recent test runs, a solution of ammonium sulphide was used as a conditioning reagent. The action of the ammonium sulphide was from all appearances almost identical with that of sodium sulphide, but the recovery in flotation runs made on the conditioned pulp was only about 90 per cent of the recovery obtained under similar conditions when sodium sulphide was used.

The New England Mill

The New England mill, near Grass Valley

A Small California Plant for the Treatment of Gold Ore

By GEORGE J. YOUNG
Associate Editor

THE New England mill, at Town Talk, between Grass Valley and Nevada City, Calif., is of interest to gold metallurgists in that it involves decantation and specific means for revivifying and "cleaning" used cyanide solutions. The mill is rated at about 50 tons' capacity per day, and is of the one-man-per-shift type. It has been used for both ore and concentrate treatment and is now operated as a custom plant. A. R. Archibald, of Grass Valley, is in charge and Fred E. Nettell is metallurgist.

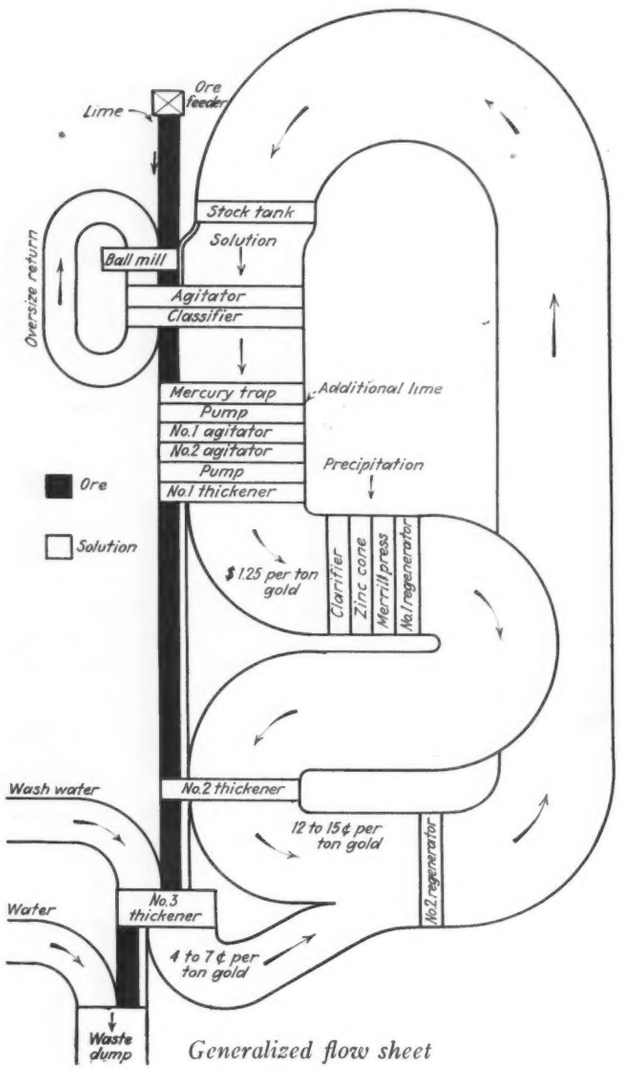
Grinding is done in a No. 6½ Marcy mill, fed by a belt feeder. The mill operates in closed circuit with a drag classifier of the chain type. A special effort is made to keep the solution ratio within the ball mill at a minimum (75 per cent solids), so that the discharge is thick. This is received in a small Devereux or propeller-type agitator, where more solution is added and the pulp overflowed continuously to the drag classifier, where oversize is returned to the ball mill. The classifier overflow passes to a mercury trap and then to a 2-in. Krogh centrifugal pump. Additional lime is added at this point. The principal portion of the lime is mixed with the ore going to the ball mill. The pump delivers to two Devereux agitators in series, and the discharge is pumped up to the first of a series of three Vandercook thickeners arranged in cascade. Each discharge is controlled by a Bradley valve, which delivers a pulp, when concentrate is being treated of a density of 55 to 60 per cent solids. The Bradley valve works efficiently and discharges a high-density pulp automatically. Overflow from the first thickener is received in a clarifying tank and filtered through suspended leaf filters (nine 3x30-in. leaves) under vacuum, being discharged to a small tank (indicator tank), which supplies the zinc cone. Zinc dust is delivered to the cone by the usual belt feeder, and the zinc "emulsion" is passed through a Merrill press.

The barren solution is pumped to a Vandercook regenerator (No. 2). This device is of interest. It consists of a 4x4-ft. open tank provided with overflows which maintain a constant depth. A 1½-in. centrifugal pump draws the solution from an intermediate point and discharges it back to the tank through a centrally placed pipe upon the end of which is a rotating four-arm discharge of the reaction type. This directs the solution against the bottom of the tank, upon which there is a quantity of mercury kept in constant agitation by the solution discharge. An air inlet is provided upon the pump suction and air is drawn in and discharged with the solution. Thorough aëration results, the solution being completely saturated with very finely divided bubbles.

The revivified barren solution is delivered to the under discharge of No. 1 thickener, where it dilutes the pulp to its former ratio of about eight of solution to one of solids. The diluted pulp is received by No. 2 thickener. Thickened discharge of No. 2, controlled by a Bradley valve, is diluted with water and received by No. 3 thickener. Overflows from No. 2 and No. 3 thickeners are delivered to a sump tank and pumped to the top of the mill to No. 1 regenerator, from which the solution passes to the principal stock tank and is ready to be used again. Underflow of No. 3 thickener, 55 to 60 per cent

solids, is thinned sufficiently to be laundered to a tailing dump.

Grinding is to 97 per cent through 200 mesh, 1½ to 2-in. balls being used on concentrates, and 4-in. balls, graded down in size, on ore. At the classifier lip it is estimated that about 85 per cent extraction is obtained upon ores, and 50 to 60 per cent upon concentrates.



Generalized flow sheet

Solution is completed on ore in the first thickener. The time cycle is estimated at about 30 hours. Overflow solution of the first thickener assays $1.25 in gold per ton; overflow of No. 2, 12 to 15c. gold per ton, and from No. 3, 4 to 7c. gold per ton. Solution losses in the tailing from No. 3 thickener are low. The quicksilver trap catches mercury and amalgam that may be in the concentrates received.

The Bradley valve is the essential feature that controls the discharge density of the thickeners and makes it possible to decant a maximum proportion of solution at each stage. A minimum of attention is required. As long as it is kept free from extraneous objects its service can be depended upon. A screen at No. 1 thickener serves to keep these out of the circuit. When the valve refuses to function, a gate valve above is closed and the Bradley valve dismantled and cleared.

Just what action takes place in the regenerator has been a subject of discussion. Oxygenation of the solutions is obvious, and this appears to be thoroughly done. Without much doubt the mercury plays a part in preventing the solutions from fouling. Both of these functions are of importance. Whether increased extraction results from the presence of more or less mercury in the solutions is a debatable point and one upon which research would be necessary before an accurate estimate of its advantageous properties could be made. It should be pointed out that in cyaniding gold ores that have been previously amalgamated more or less mercury is always precipitated along with the gold and silver. Clenneli states that mercuric cyanide is gradually decomposed by alkaline sulphides, forming mercuric sulphide and a thiocyanate of the alkali. The double cyanide is likewise decomposed by alkaline sulphides. It would thus appear that mercury, whether derived from the finely divided amalgam in the pulp or by solution in the regenerator, would act to remove alkaline sulphides.

Utilization of Anhydrite in Cement Retardation

A WIDE variation exists in the physical properties of anhydrite as it occurs in nature, and since only one sample of anhydrite was utilized by the U. S. Bureau of Mines in its early investigations concerning the action of anhydrite as a retarder for portland cement, the Bureau was urged to conduct further work to determine whether the type of anhydrite or its degree of fineness might not have an appreciable effect upon its action as a retarder. The tests which were originally outlined to cover this problem have been practically completed. Information obtained so far seems to justify the following conclusions:

It is practically essential that the clinker and retarder be ground together if consistent results are to be obtained in any investigation of this nature.

The type of anhydrite has no marked relation to its action as a retarder, but the fineness of the retarder is of considerable importance, particularly as regards its effect upon the plasticity of the cement. If properly retarded all forms of calcium sulphate will produce virtually the same quality of cement.

Although cement of good quality has been obtained by using anhydrite as a retarder, the variation in the properties of the cement clinker itself makes it essential that information be obtained concerning the retarding action of calcium sulphate before stating definitely which form, if any, is the most efficient retarder for portland cement clinker.

On the Production of Low-Cost Lime

SINCE the appearance of "Lime and Its Manufacture" in the May 12 issue, attention has been called to a unique lime plant at Eureka, Utah, owned by the Chief Consolidated Mining Company, which is producing lime at an unusually low cost. The forthcoming issue will contain a detailed description of this plant that should be of interest to consumers of lime and to those who possess properties containing limestone suitable for the manufacture of lime.

The Operation of Quicksilver Retorts

Local Conditions May Necessitate Variations in Practice

By Homar L. Johnson
Assistant Editor

HIGH PRICES for quicksilver during recent months have created much greater interest in this metal. Several old producing mines have been reopened and material formerly considered waste has become ore by appreciation in value of the metal content. In some instances, this appreciation has been aided by improved metallurgy and operation on a larger scale. An active search for new properties is under way, in which the prospector and his small retort plant are important factors.

The prospector, in searching for quicksilver deposits, keeps in mind that he must look for sufficient high-grade ore to make the operation of a retort feasible. Or, if his initial development work indicates a considerable tonnage of low-grade material, he may supplement his retort with a small concentrator, if the ore proves amenable. Custom reduction plants are unknown in the quicksilver industry, and the small operator's only hope in this connection is to find a prospect near an operating plant where his ore will be accepted on a custom, or toll, basis. Arrangements of this nature are even rarer than might be expected. In the first place, extensive sampling equipment is not provided for, normally, in the design of a quicksilver-reduction unit; second, economical transportation facilities are usually lacking, for even the short haul from the prospect to the plant; also, the prospector is likely to feel optimistic about his "mine," so he reasons, if the ore will bear the charge of transportation to the large furnace, the showing deserves a small retort installation, particularly in view of the slight outlay required.

Two Types of Retorts

Retorts are of two general types, distinguished primarily by their shape in cross-section. "D" retorts, so called because of their resemblance to the letter, but with the straight side lying horizontally, are of heavy cast iron. Johnson-McKay tubes, or pipe retorts, consist of cast-iron pipes, usually 12 in. or more in diameter and of varying lengths. Sometimes, in makeshift installations, steel pipe of smaller cross-section is utilized, but the life of such material is short, and a retort of small cross-section is difficult to charge. Generally speaking, the "D" retort is a more substantial piece of equipment and is likely to last longer with less hazard of mercurial poisoning to the operator. At the same time its initial cost is higher; it is more expensive to install; and, in the opinion of many operators, it requires more fuel than the pipe retort per unit of ore treated. However, it is easier to operate, and most retort men prefer it to the Johnson-McKay retorts.

Retorts of various capacities are utilized by small operators. Single, short-length pipes with a capacity of less than 50 lb. per charge are known, but it is more customary to use a "D" with a capacity of from 400 to

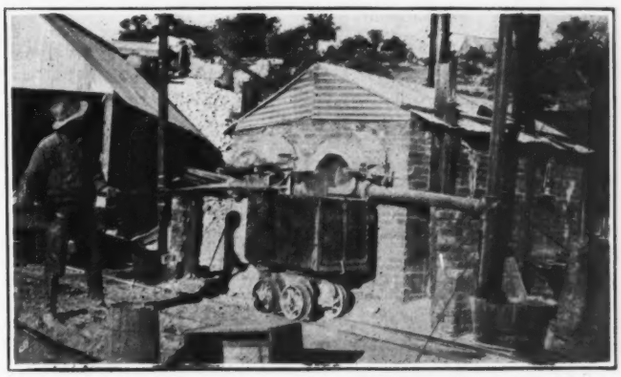


Fig. 1—Drawing the charge

1,000 lb. per charge; Johnson-McKay tubes are commonly installed in sets of six to twelve, giving a combined capacity of from 1,000 to 3,000 lb. of ore per charge. The quantity charged will vary with the weight of the ore; the skill of the operator in distributing his charge; the duration of the retorting period; and the extent to which it is advisable to fill the retort, which is a function of the character and density of the ore. With ores containing a minimum of fine or sandy material, the ore can be packed tightly into the retort, otherwise a space for gas and fume emission must be left above the charge. Preliminary crushing, or breaking, is resorted to only when the lumps of ore are larger than is the retort opening. Cinnabar is frequently associated with hydrous-silica minerals which depreciate at retort temperatures.

Common practice is to retort two charges in 24 hours, though in many instances only one charge is burned per day. In some operations three charges are attempted; this is not considered good practice, as the continued intense heat soon burns out the retorts. Ores containing a large percentage of sulphur may also prove destructive to the retort walls, and the distilled mercury therefrom is likely to reprecipitate in the condenser pipes as mercuric sulphide. This condition may be prevented by mixing lime with the ore. The retorting operation is

conducted in an atmosphere deficient in oxygen, so the lime combines with the sulphur and prevents reprecipitation of mercuric sulphide in the condensers. Hydrated or slaked lime, finely divided, is best; lump or unslaked lime cannot be mixed satisfactorily, and is less active chemically.

When only a small amount of relatively high-grade ore is being extracted, the miners sometimes make it a point to dump the lime residue, remaining from the burning of

Fig. 2—Charging the retort

carbide in their lamps, in with the ore. In subsequent handling before charging into the retorts, the lime and ore become thoroughly mixed. Authorities are generally in accord in expressing the lime mercuric-sulphide reaction as follows:

$$4\ HgS + 4\ CaO = 4\ Hg + 3\ CaS + CaSO_4$$

In the absence of an appropriate quantity of lime, a reaction between the mercuric sulphide and iron retort walls, somewhat similar to the following, is likely to take place:

$$HgS + Fe = Hg + FeS.$$

This reaction product, iron sulphide, forms a scale on the walls, which breaks off readily and is removed with the calcine or roasted ore, and rapidly destroys the iron retort.

Wood is commonly used as fuel in quicksilver retort operations. When retorts are used to treat the soot and clean-up material from a large furnace, fuel oil may be used; but, in most quicksilver operations, wood is the only fuel available. Green or uncured wood is preferred by most operators who wish to maintain an even heat in the retort. Dry wood is more likely to cause a "hot-and-cold" condition, the result being incomplete distillation of mercury in the charge, rapid deterioration of the retort, and a larger consumption of fuel. The smaller the retort, the greater the proportion of heat lost. On a "D" retort charge of 750 lb., an average figure for green scrub or jack-pine is about one cord per retort per day. The experience and ability of the operator are important factors in keeping fuel consumption at a reasonable rate. Dampers in the stacks of the smaller retort installations are helpful in controlling the draft and intensity of the heat, but for the larger retorts it is difficult to keep the dampers in working order, because of the high temperatures to which they are subjected. Frequently the damper will burn out, like so much paper, particularly with an inexperienced fireman. A check draft, such as a door on the ashpit, is an alternative method of draft control, but is not highly efficient.

The accompanying pictures illustrate the operation of "D" retorts at small properties in the new quicksilver district above Fish Lake Valley, west of Tonopah, Nev. Fig. 1 shows the operator drawing the calcine, or roasted ore. The flat, long-handled scoop is used to remove the bulk of the calcine, and a hoe-like implement with a wide blade, shaped to conform to the cross-section of the retort, is used to complete the clean-out. While emptying the retort, the outlet pipe is plugged to prevent dilution of the mercury-bearing soot, in the condenser. Fig. 2 shows the charging operation. The ability to charge a retort properly and rapidly is not inherent in all operators. Considerable strength and dexterity as well as muscular and mental co-ordination are necessary in distributing the charge evenly throughout the length of the retort. There is danger of mercurial poisoning during the charging and cleaning operations, and it is advisable for workmen to take all possible precautions while thus engaged. Generally speaking, the men available as retort operators have had considerable experience in the work and have a thorough understanding of the precautions that should be taken.

In Fig. 3 a close-up of the retort head is shown. The operator removes the plug from the outlet pipe, cleans out the condenser outlet-trough, and applies a mortar of watered wood ash to the rim of the retort head, which is placed in position and secured tightly in place with a threaded clamp. Heat quickly seals the luted retort head in place, and no loss of fume at the seal results if the

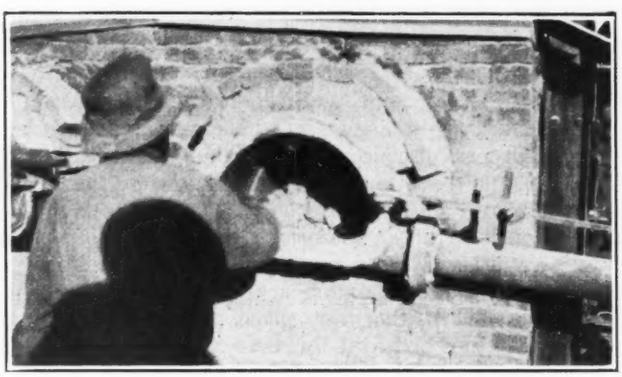


Fig. 3—Close-up view of retort head

head is properly applied and the wood ash used in the mortar has been screened. In Fig. 4 the retorts are shown with the heads in place and the distillation process actively under way.

Directly Salable Product Secured

Following the sealing of the retort head, the operator customarily proceeds to clean out the condenser pipes. A long rod with a circular metal disk or washer fastened at the end is drawn through the pipes, and the material thus secured is collected in a cast-iron pail or pot. Considerable soot of organic composition, with a varying proportion of free "quick," is secured in this way; also, a considerable amount of acid water is always associated with the soot. The material thus secured is allowed to settle for a few minutes, and most of the water decanted off. The residue is added to the material accumulated during the distillation of the previous charge. To this mass, a black slimy product, one or two handfuls of wood ash is added to give the product greater viscosity and to aid in collecting the "quick." A portion of the quicksilver can be poured off directly at

this point, the operator placing a trowel at the lip of the pail to hold back the soot and residue. The metal thus poured off is collected in a pitcher, or other container, for weighing. Additional wood ash is added to the soot, and the mixture placed on a sloping sheet-iron pan and thoroughly worked with a trowel. The metallic globules of mercury thus combine and run down the sloping pan, out of the soot and ash, draining through a small opening in the lower end of the trough-like device. The quicksilver secured in this manner is added to that previously poured off, and weighed according to specification, in the flask. A threaded plug is inserted with a coating of white lead, or red lead in oil, and the quicksilver is ready for shipment. The residuum of soot and ash is returned to the retort with the next charge, thus giving the operation a small circulating load, or middling product.

In connection with the two retorts, described and shown in detail here, it may be said that they were erected by a rancher who was not familiar with quicksilver retorts. The retort head should not project beyond the front wall of the masonry structure. The retorts shown at the right in Fig. 2 and Fig. 4 are examples of approved construction practice. "D" retorts are made by the Thompson Brothers Iron Works, San Francisco, and installation blueprints and detail drawings for erection may be secured from the H. W. Gould Company, Mills Building, San Francisco.

The condenser system of these retorts consists of two lengths of 4-in. cast-iron pipe, the shorter length connecting at the bottom and side of the retort-head and leading off, at a slight slope, at right angles with the major axis of the retort, as shown in the illustrations. This pipe is about 4 ft. long, connecting with a crossover fitting, leading into an 8- to 12-ft. length of pipe, considered as the main condenser. The crossover is used in place of an ell or tee, to provide an opening for the insertion of the clean-out rod. Wooden plugs in preference to threaded cast-iron plugs are normally used at

Fig. 4—Retorting the charge

the openings in the cross-over because the sulphurous gases rapidly destroy the threads of cast-iron fittings.

The condensation problem has caused considerable variance of opinion. In the accompanying illustrations the condenser pipes are seen to be vertical, a condition that most quicksilver men would condemn. In this particular installation several good reasons existed for maintaining the condenser pipes in this position during certain months

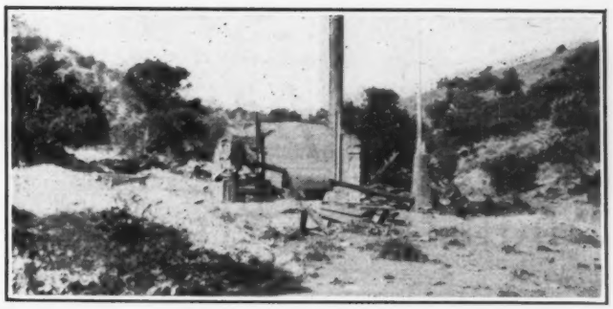


Fig. 5—Approved condenser installation on small retort

of the year. The exposed head on the two older retorts resulted in a decrease in temperature throughout the condenser systems. During cold weather it was discovered that the condenser pipes, if placed in the normal position and close to horizontal, would freeze up solid at night, and sometimes during the day shift, in spite of efforts by the operator to keep them open. Wrapping the pipe with burlap or other material would assist to a certain extent, but if extremely cold weather set in this would prove an unsatisfactory makeshift. Because the heads on these retorts were exposed, it was considered advisable to experiment with the condenser pipes in the vertical position in extremely cold weather, particularly in view of the possibility of getting away from the bad freeze-ups occurring when the condenser pipes were in a semi-horizontal position. The changing character of the ore made it difficult to secure definite checks on the results obtained with the condenser pipes in the two positions, but operations before and after the change were reasonably consistent, so it was decided to continue during the winter with the vertical pipes.

Relative Condenser Efficiency

A few weeks later two new retorts were installed, according to specifications, with inclosed head. After a short "breaking-in" period, comparative test runs were conducted between the older retorts, with exposed heads and vertical condenser pipes, and the newly installed retorts, first with main condensers at a small angle from the horizontal and later with the condensers vertical. During below-zero weather, the vertical condensers revealed only slightly less satisfactory results than did the condensers in their normal position; and, in view of the difficulty in keeping ice out of the pipes in the close-to-horizontal position, the advantage rested with the vertical condensers.

Standard condenser practice is represented in the small retort installation pictured in Fig. 5. Topography, in this instance, aids the installation, the main condenser pipe being placed at a greater angle below the horizontal than is ordinarily practicable. This condenser leads into a small adobe housing, where the usual cast-iron pot catches the condensed mercury as it trickles down the pipe. A door is provided for removal of the pot at clean-up time. Gases are exhausted through the vertical stove-piping shown in the picture.

The sulphurous and complex organic gases driven off in retorting are offensive and disagreeable. Frequently they cause nausea and sickness on the part of the retort operator who is required to work in an atmosphere from which these gases have not been removed. Hence the long length of stove-piping is necessary to maintain satisfactory working conditions.

Copper Outlook Brighter

Industry in Strongest Position Since the War

By A. B. PARSONS
Associate Editor

AFTER an almost uninterrupted climb from a low average of about 12⅝c. per pound, delivered, in June, 1927, copper reached 14¾c. in the closing days of May, 1928, and has remained there since—the present article being written on Aug. 1. The average delivered price for the first seven months of 1928 is close to 14⅜c., compared with 13¼c. in 1927, and a little

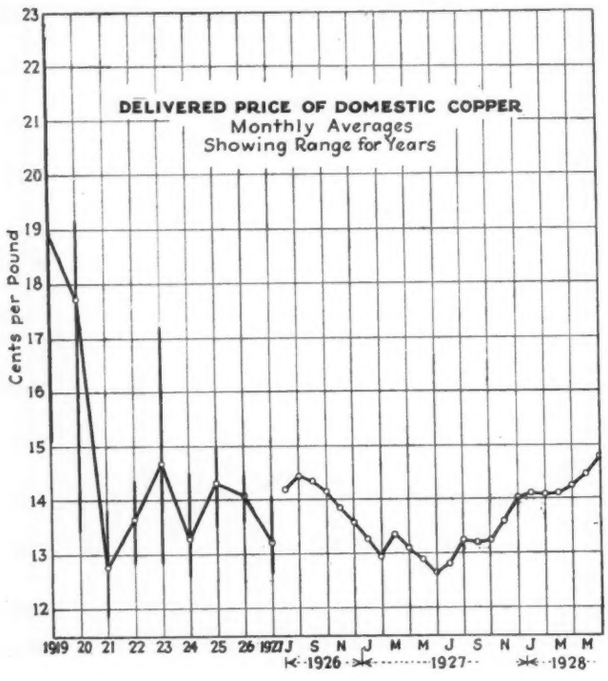


Chart 1

better than 14c. in 1926. Such financial reports as have been issued thus far in 1928 show marked improvement in earnings of copper-mining companies. Greene-Cananea and Granby Consolidated recently resumed dividend payments; Anaconda, Phelps Dodge, and Cerro de Pasco have increased their dividend rates since the first of the year, and speculation pervades Wall Street as to which will be the next copper company to do likewise.

It is clear that the industry as a whole is in a much better position than a year ago, and the companies that, for one reason or other, enjoy the distinction of being in the "low-cost" class are making excellent earnings with the market at current levels. That is not to say that *all* companies are so fortunate: the marginal producers still are in the picture. Contemplating the rapid and substantial rise of more than 2c. in a single year, it is fair to say that the early price was altogether too low, rather than that the present price is unwarrantably high. Monthly averages are shown in Chart 1.

What has happened during the year to improve the position? The first thought of those informed on the subject in only a general way is the Copper Institute. In some quarters there has been a tendency to credit or accuse the Institute with being a considerable factor in the advance in prices; actually its real effect has been to eliminate much of the erratic fluctuation that is deprecated by buyers as well as by sellers. The Institute is a trade association that began to function about eight months ago. Its members include companies that represent 90 to 95 per cent of the copper production in North and South America. Its principal function—so far, at least—has been to collect and compile weekly statistics showing *en bloc* figures for production, stocks, and sales (tonnages, delivery districts, month of shipment and prices), for prompt distribution among its members. Through it each producer is able to ascertain with fair accuracy the position in the aggregate of the groups on both sides of the marketing fence.

Heretofore each seller of copper has been groping around in the dark ready to jump at his own shadow. In the background, it is true, has been the knowledge that the industry has been equipped to produce somewhat more copper than was being currently used and that a sizable expansion in the total output was a possibility at any time. Consumers profited from this psychological advantage to the utmost. After a period of a few weeks of scant buying, some producer would suspect that a competitor was cutting prices (in which impression he was subtly encouraged by the buyers) and would start the demoralization of the market by reducing his own price. Primary producers as well as "custom" sellers were guilty. No one denies that the data distributed by the Copper Institute have enlightened producers and sellers

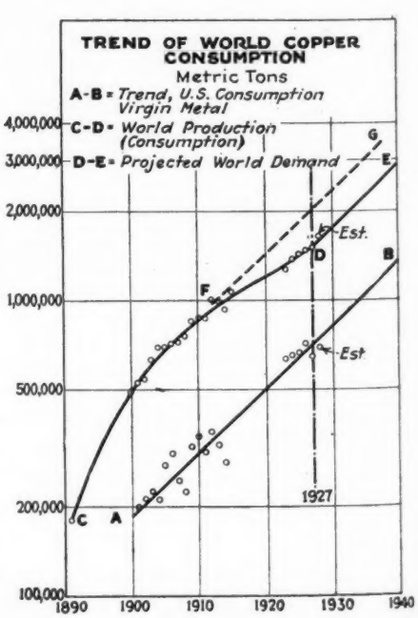


Chart 2

of copper and thereby eliminated some of the rapid see-sawing that heretofore characterized the curve of copper prices. At the same time there are more important elements of strength in the situation to which the general improvement in the price level may be justly ascribed; and these same elements tend to brighten the outlook for the future.

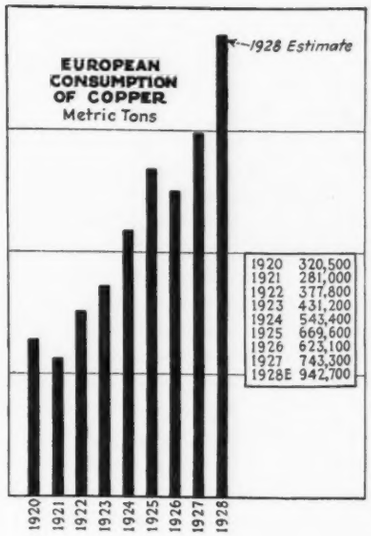


Chart 3

Consumption—Chart 2 is the result of an attempt to show graphically what may reasonably be expected as the trend of future consumption of copper in the world. The data are plotted on semi-logarithmic paper; that is to say, the vertical subdivisions are on a logarithmic scale. As a consequence it is possible by drawing a line parallel to another to represent an equal annual rate of increase, irrespective of the comparative magnitude of the quantities involved. The line *AB* is based on data from the U. S. Bureau of Mines and the Geological Survey for the apparent domestic consumption of virgin metal for various years up to 1927. The estimate for 1928 is based on domestic deliveries for the first half of the year. The war and early post-war periods are omitted for the reason that they distort the picture and are meaningless. *AB* indicates what may be called the normal trend of consumption in the United States since 1901. *CFD* is world production according to data from the American Bureau of Metal Statistics, the figure for 1928 being an estimate based on data for the first half of the year. Over a period of years world production and consumption of course are substantially the same. A fair hypothesis is that had it not been for the incidence of the World War, consumption would have increased approximately at the rate of actual increase in the United States, and would have been represented by the dotted line *FG*.

Now, if one is ready to accept the conclusion that European recovery has progressed sufficiently to permit the resumption of normal industrial activity, it seems reasonable to project the line *DE* as representing the trend of world consumption of new metal. The area *GFDE* then represents a sort of European "deficit" created by the war; and the line *DE* assumes that this deficit never will be made up. Possibly I am overly optimistic in assuming that European rehabilitation has advanced so much: perhaps another year or two should be allowed to elapse before the position of point *D* is determined. However, the following facts are significant in this connection:

1. Production figures for the first half of 1928 show that the world rate is 107 per cent of the average for 1927. On this basis, production (consumption) will be 1,630,000 metric tons, establishing a point for 1928 somewhat above the projected line *DE*.

2. European consumption, as indicated on Chart 3, except for a slight recession in 1926, has increased steadily and rapidly since 1921. The estimate of 942,700 metric tons for 1928 is arrived at by dividing the sum of the average net monthly imports of Great Britain, Germany, France, Italy, and Belgium for the months for which data are available in 1928, by the sum of the averages for 1927, and using the resulting fraction as a factor by which to multiply the consumption in 1927. If, instead of the averages for all of 1927, the averages for the corresponding early months had been used, the result would have been substantially higher, as net imports increased in the latter half of 1927.

3. It is generally conceded that the limiting factor to the rate at which most of the European countries have rehabilitated their electrical utilities, expanded their hydro-electric and steam-electric power developments, and revived industrial activity in general has been the ability to obtain the necessary capital. Consequently, it is significant that foreign loans floated publicly in the United States during the first half of 1928 far exceed those of any preceeding similar period. According to one compilation by the U. S. Department of Commerce, the total par value of stock and bond issues coming under this category was in excess of $1,000,000,000. A compilation from *The Financial Chronicle* of loans floated during April, May, and June, by private companies and municipal and other governments in Germany, Poland, and Italy, essentially for electrical development and expansion, shows a total par value of $114,050,000.

4. Indicative of the improved financial and industrial health of Europe as a whole is the return of all the important countries to the gold standard. In many instances this was accomplished during 1928, France being the last to attain this end, late in June. According to the Paris correspondent of *The Economist* (London) "Stabilization has given a distinct stimulus to the nation as a whole, and there are many signs, now that the franc has been freed from peril, of a pending widespread revival of economic and industrial activity." A bond issue of 1,700,000,000 francs ($66,000,000) for postal and telephone development was oversubscribed in 48 hours.

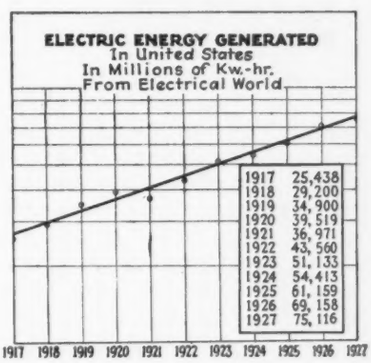


Chart 4

Ever since the war, copper producers have been waiting for Europe to take its "normal" share of copper. Consumption in the United States has been fully up to expectations, and no reason is apparent for doubting that it will continue to be. The electrical industry, of course, is overwhelmingly the greatest outlet for copper—taking more than half the total. The phenomenal growth of the industry in the United States, indicated in Chart 4, will not slacken, according to best authorities. The straight line on a semi-logarithmic scale indicates a steady *rate* of increase in the power generated and distributed; it actually tripled in a period of ten years. Automobile manufacture, telephone installation, and building construction are the other single industries that take important proportions of the total consumption of copper;

and with respect to these the outlook surely is good. To sum up the subject of consumption or demand, it does not seem improbable that the trend indicated on Chart 2 fairly approximates what actually will develop, assuming no exorbitant increase in price. Reading from the graph the following round figures are obtained:

Year	Metric Tons	Short Tons
1931	1,860,000	2,050,000
1933	2,030,000	2,230,000
1935	2,230,000	2,450,000

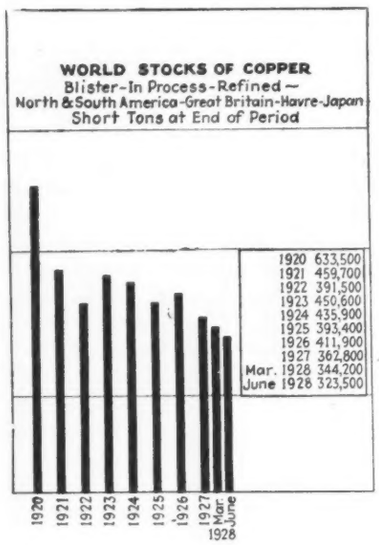


Chart 5

Production—Those who profess to foresee a copper famine in the next ten years cannot make a convincing case, in my opinion. Plenty of copper will be forthcoming. The price may climb farther than I think, and the consumption may fall below the figures forecast in the graph. However, so many things may happen in a decade that it is safer to confine any forecasts of specific nature to the less distant future.

From the accompanying charts, 5 and 6, showing stocks, it is clear that consumption has been more rapid than production, broadly speaking. At the end of June refined stocks in North and South America, as well as world stocks, including blister and "in process" metal, reached the lowest level since the war. Unquestionably this has been a factor in the recent strength of the market. The relation of consumption to actual production, not to the potential production, ought to be the primary influence that affects the market price of a commodity. The reason that "potential overproduction" has played an important part in the copper market in recent years is that producers of copper allowed it to, in the manner which I have already attempted to outline. That psychological weakness appears to have been overcome; producers now must guard against the possibility of speeding up output to the extent that instead of potential they will have actual overproduction of substantial proportions.

High production usually has two objects: first, to cut per-pound costs; and, second, to increase the number of pounds to be sold. However, a little figuring will demonstrate that a comparatively small decline in the market price of the metal may easily reduce the margin of profit on each pound to such an extent that the advantages mentioned are more than offset and net earnings are less than with a lower production rate.

To what does this much-discussed "equipped" production in excess of the current rate really amount, and how soon will the slack be taken out? In an effort to answer these questions I have listed in Table I the principal producing companies, their actual output in 1927, and an estimate of what they could produce with their existing plant operating with a reasonable degree of efficiency. Necessarily, many of these data are conjectural, but the net result ought to be fairly close to the truth. In some instances the present equipped figure is substantially lower than production attained during war years. Three factors should be considered here: (*a*) War production was at high pressure; the price was around 25c., demand was unlimited, and production was a contribution to a Cause. Consequently, mines and reduction plants were "strained" in a way that would not be justified in normal times. (*b*) By and large, ores of lower grade are being treated, so that the same tonnage of ore (by which the capacity of the plant usually is gaged) contributes less copper to the total supply. (*c*) Development in ore-dressing technique has necessitated finer grinding; and as grinding capacity usually limits the capacity of the concentrator, production in terms of copper is decreased. Against this last must, of course, be set the increase in percentage recovery of metal.

Regarding this overcapacity, it is important that it does not exist as the result of the recent installation of costly equipment, made with newly raised capital, nor was it stimulated by a recent mistaken notion that a famine threatened, as was the case with tin, for example. The illness is an old one; the industry is really convalescent. All that is necessary is to take things easy until normality returns.

Calculating an allowance of 5 per cent increase for the unlisted companies in the 1927 list, the equipped world capacity is 2,076,000 tons, or only about 26,000 tons more than the estimated consumption in 1931. By 1931, however, certain new production may be expected, notably that from the Frood mine of the International Nickel Company, which should be producing at the rate of 30,000 tons per year late in 1930. Union Minière, with its program of gradual expansion, may contribute 30,000 tons over and above the 120,000 allowed in the table.

Table I—Production in 1927 and Equipped Capacity of Important Copper Producers

	Production, Tons Actual, 1927	Equipped Capacity		Production, Tons Actual, 1927	Equipped Capacity
Anaconda	101,955	135,000	Walker	4,682	5,000
Ariz. Com.	2,753	3,000			
Butte & Superior	2,016	2,000	Total U. S. A.	790,779	938,000
Calumet & Arizona	24,082	35,000	Granby	27,706	28,000
Calumet & Hecla	60,077	70,000	Howe Sound	17,475	23,000
Cons.Coppermines	9,446	10,000	Noranda	250	25,000
Copper Range	11,337	15,000	Interna'al Nickel	11,500	12,000
East Butte	2,922	3,000	Mond Nickel	9,500	10,000
Engels	6,061	6,000	Boleo	11,625	12,000
Inspiration	44,229	60,000	Cananea	14,369	30,000
Kennecott	17,372	20,000	Mazapil	5,488	6,000
Magma	14,251	17,000	Moctezuma	18,000	20,000
Mason Valley	6,846	8,000	A. S. & R., Mexico	9,830	10,000
Miami	26,519	27,000	Andes	27,188	105,000
Mohawk	11,062	12,000	Braden	101,484	115,000
Mother L de	10,294	10,000	Cerro de Pasco	45,205	50,000
New Cornelia	36,466	50,000	Chile	109,800	175,000
Nevada Con.	44,747	55,000	Naltagua	5,620	6,000
Chino	32,020	36,000	Poderosa	2,378	2,000
Ray	32,572	35,000	Furukawa	17,911	18,000
Ohio	2,413	2,000	Union Miniere	98,277	120,000
Old Dominion	10,816	10,000	Namaqua	2,882	3,000
Phelps Dodge(U.S.)	74,429	76,000	Bwana M'Kubwa	5,434	7,000
Shattuck Denn.	2,073	4,000	Mt. Morgan	2,225	.....
Seneca	1,441	2,000	Mansfeld	25,395	25,000
Tennessee	5,532	7,000	Mt. Lyell	6,566	8,000
United Ver 'e	49,745	55,000	Total foreign	576,108	815,000
U.V.X.	20,651	22,000	U. S. and foreign	1,366,887	1,753,000
Utah Delaware	1,937	2,000	Unlisted	307,931	323,000
Utah Apex	3,532	4,000	Total Short tons	1,674,818	2,076,000
Utah Copper	116,501	140,000	Total Metric tons	1,519,000	1,884,000

Two projects for which definite commitments have been made are the Flin Flon, in Manitoba, and the Roan Antelope, in Rhodesia. However, in spite of construction schedules that are officially announced, it is probable that 1932 will be the first year to see any considerable production from either of these. Other companies prob-

ably will have added to their equipped capacity in anticipation of greater demand for copper. On the other hand, some of the mines represented in the 1927 list are likely either to be worked out or to be contributing much less to the total output. Among these may be mentioned

Table II—Additional Sources of Production in 1935, Compared with 1931

	Tons
United States	
Utah, Calumet & Arizona, Nevada Con., Inspiration, New Cornelia, Phelps Dodge (Morenci), and Calumet & Hecla	80,000
Canada	
Flin Flon	20,000
International Nickel, Mond, Noranda, Errington, Buchans River, Sherritt-Gordon and Mandy	80,000
Africa	
Roan Antelope	50,000
Union Minière, N'Changa, N'Kana	60,000
South America	
Cerro de Pasco, Chile, Braden and Andes	75,000
Mexico	
Greene Cananea, Moctezuma	15,000
Russia	15,000
Australia	5,000
Total	400,000

Arizona Commercial, Butte & Superior, East Butte, Kennecott (Alaska), Mother Lode, Ohio Copper, Copper Queen, Old Dominion, United Verde Extension, and Utah Apex—not to venture outside of the United States. At none of these is the ore position as favorable as the owners would like. Accordingly, it seems not unreasonable to predict that 1931 will mark the disappearance of the ghost that has plagued the copper industry so much since the war—namely, potential overproduction. It should be emphasized that the details in the tabulation are unlikely to coincide closely with the actual figures of production in 1931, but the total I think will not be far from the real total. Next comes the question of the source of the added metal to meet the requirements for subsequent years. In

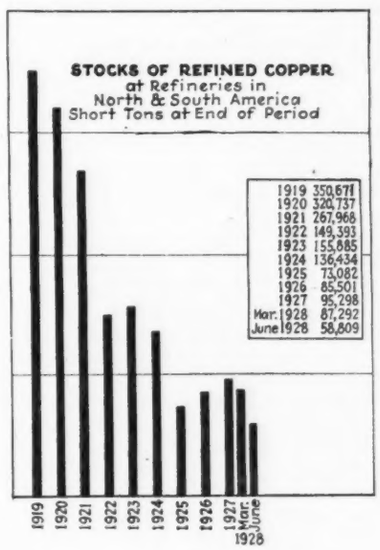


Chart 6

1933, according to estimate, an additional 180,000 tons will be needed, and in 1935 an additional 400,000 tons. Table II, excepting a few items, is largely conjecture. It shows places where copper can be obtained, though in most instances steps would have to be taken a year or two in advance to provide the necessary equipment. If it develops in the next seven years that the rate of increase in demand assumed in Chart 2 is not maintained, the economic incentive to expand capacity, to the extent indicated in Table II, will be lacking. But if the metal is needed, it should be forthcoming, presumably without the stimulus of any pronounced advance in the price level, though a general upward trend does not seem improbable. After 1935, if consumption continues to increase at the assumed rate, it may be that higher prices will be needed to bring out the required metal; but higher prices will tend to lessen consumption. As is always the case, a balance will necessarily be struck between the requirements of industry and the price at which enough copper will be produced to meet these requirements.

Price—Without venturing any specific predictions on the question of price, two significant points may be mentioned:

1. Important reductions in cost of production, comparable with those brought about by technical and engineering achievement in the last ten years, are not to be expected. One reason is that instead of a margin of perhaps 30 per cent, in which to improve metallurgical recoveries, there is now only about 10 per cent on which to work. A second reason is that mechanization of the processes of mining and treatment has so reduced costs that there is little room for further improvement.

2. Profits are by no means excessive. Table III shows per-pound earnings, *before* charging depletion, realized by 21 representative American companies. Earnings of this group amounted to 8.3 per cent and 7.8 per cent of the invested capital for 1926 and 1927, respectively. As a wide range exists in the per-pound earning capacity of different companies, it is apparent that the marginal or "near-marginal" group is not to be ignored. It is not the average profits of the industry, but the profits of the companies which are less fortunately circumstanced with respect to richness of ore and other endowments of nature, that must be viewed as a factor in ascertaining the price at which copper should sell. Taking into account the one peculiar inherent characteristic of mining enterprise—the exploitation of a wasting asset—higher prices for the metal seem to be warranted.

Looking at the immediate future, the problem of the individual copper-mining companies is to restrain any temptation to expand production more rapidly than the increase in demand warrants; each is getting information that enables it to gage consumptive requirements with some degree of accuracy in advance, and common sense should dictate how rapidly to increase output. By the end of 1931, consumption should be sufficient to permit existing plant to operate at full capacity. Subsequent probable increases in requirements can be judged in the interim, and plans for expansion should be made so as to meet these requirements without creating unnecessary surplus capacity.

So far as prices are concerned, the outlook is satisfactory, and with the opportunity offering for the present producing companies gradually to expand production, earnings of the mining companies should be better than

Table III—Per-pound Earnings of American Copper Mining Companies

In Cents, before Charging Depletion

Company	1926	1927	Company	1926	1927
Calumet & Arizona (*a*)	3.3	2.4	New Cornelia	4.5	4.3
Calumet & Hecla	2.9	2.3	Old Dominion	1.4	...
Chile	6.5	5.7	Phelps Dodge	2.4	2.0
Copper Range	0.4	0.7	Tennessee Copper	8.3	3.7
Granby	1.6	1.4	U. V. X.	6.1	4.1
Inspiration	1.6	1.4	Utah (*c*)	5.2	4.9
Kennecott (*b*)	5.5	5.7	Engels	1.3	1.1
Magma	4.2	2.9	Howe Sound	9.4	6.1
Miami	2.1	2.2	Cerro de Pasco (*d*)	8.5	10.3
Mohawk	4.8	4.8			
Mother Lode	7.3	5.8			
Nevada Con.	3.3	2.8			

(*a*) New Cornelia excluded.
(*b*) Utah excluded.
(*c*) Nevada Con. excluded.
(*d*) Depletion deducted.

they have been, by and large, since the war. The metal-mining industry is rightly entitled to somewhat higher returns on its capital than most other industries, and copper mining, taken as a whole, has not enjoyed this advantage since 1920. The stage seems set for an era of better times for copper.

COMMENT AND CRITICISM

The Tin Resources of the United States

THE EDITOR:

Sir—In the article in your issue of July 28, 1928, entitled "New Attempt to Develop Temescal Tin Deposit in Southern California," Mr. H. E. West states that tin has been produced from only three localities in the United States. This is probably an error, for there are at least three additional places where it has been found and mined in a small way: near El Paso, Tex.; at Kings Mountain, N. C.; and at Teller, in the Seward Peninusla, Alaska. I am under the impression it has been found in very small quantity at other points, but I cannot at this time recall just where they are.

Of the three localities I have mentioned, that in the Franklin Mountains a short distance northwest of El Paso is by far the most important. Walter Harvey Weed described the ores and geology of the section in the El Paso Folio of the U. S. Geological Survey. Some years ago, I think about 1909, I made for a Philadelphia client a thorough examination of these deposits, which resulted in an unfavorable report, and my client did not invest. The promoter of the scheme, however, although he knew of the character of my report, persisted and succeeded in persuading a number of wealthy men to put several hundred thousand dollars into the project. The promoter then employed a first-class millman and metallurgist to design and erect a mill and smelter. He began the development of the mine and succeeded in producing enough ore to yield several hundred pounds or even a few tons of pig tin; then he went broke, and the whole thing was a financial failure.

To a geologist these El Paso tin deposits in the red granite are very interesting. They consist of several distinct fissure veins, with some metasomatic replacement by the cassiterite in the vein walls. The veins could not be traced far, the volume was small, and there were no excavations in depth at the time of my visit. Later, when developed, I understand they petered out completely. My unfavorable report was based on the lack of development and the insistence of the promoter in building the plant before proving the mine. A curious side issue of this affair is that my client was a man who had been a successful investor in mines, whereas the others were inexperienced, and had social and business connection with the promoter and so were more disposed to accept his views than those of the engineer. I have had similar experiences before and since, and it is a sad commentary on the poor judgment of otherwise successful business men who thus lose their money and consequently condemn all mining ventures as a snare and delusion.

The tin deposits of the Seward Peninsula, Alaska, are rather promising. There are some U. S. Geological Survey reports relating to them. The small creeks draining the granite area back of Cape Prince of Wales carry "stream tin" and have to some extent been dredged, but whether profitably or not I do not know. I was at Teller in 1914, but as the season was late I had not time for any examinations. It is a rough country, covered with tundra, but there is no reason to suppose that no vein deposits large and extensive enough to operate may not eventually be discovered there. As far as I know, nothing of the kind has yet been developed.

American mining engineers, geologists, and prospectors are, as a rule, quite unfamiliar with the geology and character of tin deposits, which may to some degree account for none of any particular value having been found in North America. This is an area vastly larger than Europe, in which at least two great tin-producing areas have been worked since ancient times—namely, Cornwall, in England, and the Zinnwald of Germany. That we ought ultimately to discover tin in workable quantities in some of the great granite areas of the Pre-Cambrian of Canada, Newfoundland, and the United States would seem to be no unreasonable hope. Until that time we must be dependent for our rapidly increasing needs upon foreign sources which are by no means inexhaustible and from which we might at any time be cut off.

I know nothing about the North Carolina deposits; probably they resemble those of the Cash Mine, at Irish Creek, on the eastern slope of the Blue Ridge, in Rockingham County, Va. At this place I think they once had a mill and a small smelter, but never produced any respectable amount of pig tin. The place is famous among mineralogists as yielding beautiful crystals of cassiterite, and has, at various times, been promoted as a mining proposition. I recall once advising a client not to invest any money in it. The Etta mine, in the Black Hills, is also similarly distinguished, owing to the peculiar association of the cassiterite with the rather rare mineral, spodumene. It likewise has never been of any economic importance, although it has been promoted and technically discussed in some of the earlier *Transactions* of the A.I.M.E.

Recently I examined some fluorspar deposits in one of the Pre-Cambrian areas of Newfoundland, which reminded me of Cornwall. The fluorspar is of excellent quality, in veins of some width but small length, and the whole country is pretty well covered with tundra. It seemed to me a good place to look for tin, but as far as I could find out none has ever been noticed there.

The Temescal deposits which Mr. West writes about in the article mentioned, created quite a stir some years ago and were extensively advertised. I have never seen them, but always understood they were interesting and seemingly promising. I am glad to know they are being intelligently developed, which I surely hope will meet with success.

F. LYNWOOD GARRISON.
Westtown, Chester County, Pa.

An Appreciation

THE EDITOR:

Sir—We have read with interest the letter of Mr. George Schumacher, of Medford, Oregon, entitled: "Art vs. Science in Southern Oregon," in your issue of July 21, 1928. Mr. Schumacher's stand is to be highly commended; we had occasion, a short time ago, to verify on the spot most of his statements; he says in a clever and humorous way some needed plain truths. Publicity like his, helping to separate the chaff from the wheat, is much needed in developing the mineral resources of our western states.

Denver. ARTHUR E. HEPBURN
ETIENNE A. RITTER.

Milling Fluorspar

THE EDITOR:

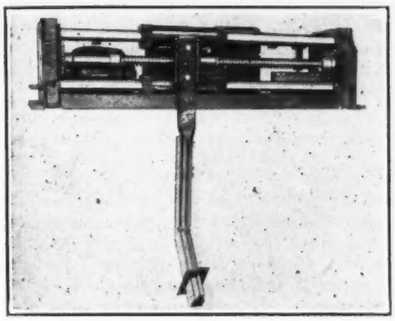
Sir—On page 981 of the June 16 issue of *Engineering and Mining Journal* is an inquiry concerning "Methods of Milling Fluorspar." I do not know of any process using an air centrifuge for the separation of the decrepitated fluorspar and doubt very much if this can be done, owing to the very slight difference in specific gravity between the fluorspar and its silica and lime content. I do know, however, of the successful use of wet gravity concentrating tables used in connection with the decrepitation process. B. J. ROBERTS.
Fort Wayne, Ind.

INDUSTRIAL PROGRESS

A New Automatic Sampler

By H. D. Keiser
Associate Editor

AN AUTOMATIC electrically-controlled sampler, the cutter of which moves horizontally at a uniform speed across the stream, has just been placed on the market after satisfactorily meeting tests made during the last two years under practical operating conditions.



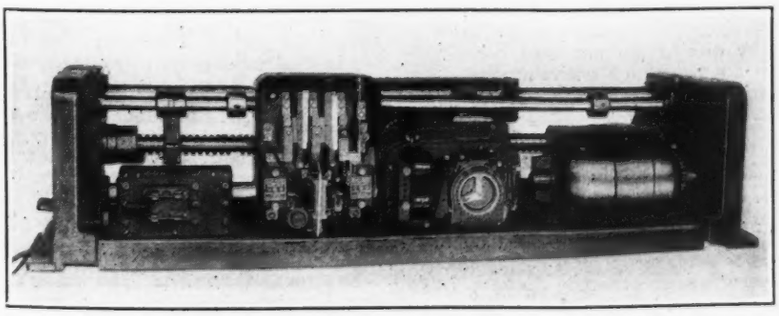
Front view of sampler with housing removed. Screw driving the cutter carriage, cutter carriage, and cutter bar are seen

The apparatus was designed jointly by J. F. Geary, consulting mechanical and metallurgical engineer, of Salt Lake City, and H. C. Jennings, metallurgical engineer with the General Engineering Company.

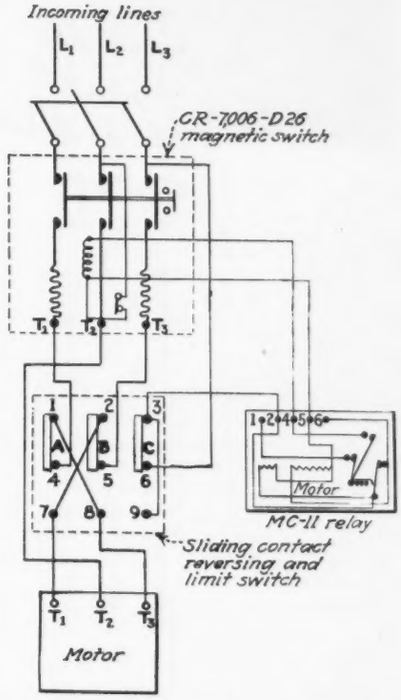
When in operation, the sampler is equipped with a close-fitting housing (removed in the illustrations) that enables the apparatus to be employed under wet or dusty conditions. This housing may be locked in place, so that it is impossible for anyone to tamper with the mechanism. Another important feature of the device is that any number of the samplers installed at various points in a plant may be operated through a central control mechanism placed at a remote point, such as the plant superintendent's office. Details of the device are shown in the accompanying photographs and drawing.

The following electrical equipment is used in the construction of the sampler: A three-pole disconnect switch, a CR-7006-D-26 magnetic switch, an MC-11 timing relay, a sliding-contact reversing and limit switch, and an RKT-$\frac{1}{4}$-hp.-1,725 r.p.m. motor. All of this equipment, with the exception of the sliding contact reversing and limit switch, is manufactured by the General Electric Company.

Operation of the sampler is as follows: Assume the sampler carriage is motionless at the end of travel in one direction. Magnetic switch, D-26, is open. The motor of the timing relay is operating and receiving power from L-3 through 3 and 6 of the limit switch. At the end of the time interval for which the relay is set, the relay closes on contact 4. This action completes the coil circuit of the magnetic switch, which closes and starts the driving motor. The sampler carriage is moved by means of a long feed screw to the end of travel in the other direction, where it strikes the reversing switch. This switch, through segments *A* and *B*, reverses the motor connections. As segment *C* slides across, however, there is a short interval when it is not in contact with either 3 or 9. During this period the magnetic switch drops out, and the timer is reset. The timer motor and magnet are re-energized immediately as points 6 and 9 of the reversing switch are connected. At the end of the time setting, the timer closes on its contact 4 again, and the sampler is moved across in the opposite direction. This cycle continues indefinitely.



Rear view of sampler with housing removed. Electrical mechanism of the apparatus is shown



Wiring diagram of electrical mechanism that operates the sampler

Three of the samplers were installed in the flotation plant of the U. S. Smelting Company at Midvale, Utah, in February, 1926. Since then ten other units have been built and placed in operation at the Buchans River and South American plants of the American Smelting & Refining Company. All these installations have proved entirely satisfactory.

Acetylene Flood Lights Have Slight Effect on Mine Air

TO DETERMINE the effect of the operation of acetylene flood lights in metal mines, the Oxweld Acetylene Company, of New York, has recently concluded an investigation, which shows that with the standard No. 2 Carbic light burning at a normal rate, 3.332 cu.ft. of acetylene would be generated per hour and that in the combustion of this amount of acetylene 8.33 cu.ft. of oxygen from the air would be consumed. This would indicate that 39.7 cu.ft. of air is required to complete the combustion and that 6.66 cu.ft. of carbon dioxide would be produced. Following the matter still further, the investigators found that the amount of ventilation required to avoid reducing the oxygen content of the mine air below 17 per cent would be 208.2 cu.ft.

Acetylene flood light at a mine face

per hour, and that the ventilation required to avoid accumulating over 2 per cent carbon dioxide would be 336 cu.ft. per hour.

The depletion of oxygen, especially in the presence of increasing percentages of carbon dioxide, is more likely to prove undesirable than an excess of carbon dioxide in an atmosphere approximately normal with regard to the oxygen content. Obviously, however, according to the investigators, if sufficient ventilation is provided to maintain the carbon dioxide at 2 per cent or less, no anxiety need be felt as to a deficiency of oxygen.

These figures show that even with only natural ventilation so great an excess of air is available that the effect of oxygen consumption of acetylene flood lights is practically negligible. Expressed in another way, the oxygen consumed by a Carbic light and the proportionate carbon dioxide produced is slightly less per hour than the effect on the atmosphere produced by the respiration of three men.

Dorrco Filter for Chile Nitrate Work

Arrangements have been made with the Anglo Chilean Consolidated Nitrate Company, a Guggenheim concern, for the shipment of a trial Dorrco filter, 4x3 ft., to Chile for experimental work. The filter will be used for the removal of insoluble matter from a nitrate solution and removal by washing on the filter of the bulk of the valuable solution. Details of the operation are somewhat involved, but should the filter perform successfully a large and lucrative new filter field may be developed.

INDUSTRIAL NOTES

The Roller-Smith Company, 233 Broadway, New York, has announced the appointment of E. E. Van Cleef, 53 West Jackson Boulevard, Chicago, as its district sales agent in that territory. He will have associated with him M. B. Mathley, long connected with the Chicago office.

The Girard Smelting & Refining Company, secondary smelters and refiners, of Richmond and Tioga Sts., Philadelphia, have purchased the Philadelphia plant and property formerly occupied by the Tacony Steel Company. It is situated on the Delaware River, on the main line of the Pennsylvania Railroad. Installation of equipment and various improvements will require about a year, after which the company will house its business in the new plant.

J. T. Baker Chemical Company, Phillipsburg, N. J., has announced that the office of Dissosway Chemical Company, 55 Eckford St., Brooklyn, has been closed. All inquiries and orders are to be addressed to J. T. Baker Chemical Company, New York, in the Graybar Building.

PATENTS

CONCENTRATING TABLE. No. 1,678,364. July 24, 1928. A. H. Stebbins, Los Angeles.

ROCK DRILL. No. 1,678,985. July 31, 1928. Josef Kohlen, Herne, Germany.

ROCK DRILLS. No. 1,679,131. July 31, 1928. James G. Graham, Butte, Mont., assignor to Sullivan Machinery Company.

MINE CAR. No. 1,678,563. July 24, 1928. G. E. Edmunds, assignor to Bonney-Floyd Company, Columbus, Ohio.

RUBBER PROTECTOR FOR BLASTING-CAP. No. 1,678,257. July 24, 1928. George A. Livermore, Joplin, Mo., assignor to B. F. Goodrich Company, New York.

FILTER. No. 1,678,639. July 31, 1928. A. L. Genter, Salt Lake City, Utah, assignor to United Filters Corporation, New York.

This patent covers a scraper for rotary filters of the leaf type.

COPPER METALLURGY. No. 1,679,294. July 31, 1928. Ferdinand Dietzsch, Kingston-on-Thames, England.

A process for treating copper sulphide ores by mixing the ore with alkali sulphate in a proportion not exceeding 2 per cent of the weight of the ore, roasting the mixture, and finally extracting the values.

GOLD CONCENTRATOR. No. 1,679,035. July 31, 1928. W. A. Huelsdonk, Merced Falls, Calif.

A shaking receptacle with a riffle bottom. The gold collecting in the riffles is caused to move along them by the shaking movement, and is ultimately discharged into a chamber provided for the purpose.

ZINC METALLURGY. No. 1,678,607. James A. Singmaster, Frank G. Breyer, and E. H. Bunce, Palmerton, Pa., assignor to New Jersey Zinc Company.

A method of reducing zinciferous materials by confining an agglomerated charge of mixed zinciferous material and carbonaceous reducing agent in an upright retort, and subjecting the charge to a sufficiently high temperature to reduce compounds of zinc and volatilize the resulting metallic zinc.

FILTER. No. 1,678,704. July 31, 1928. W. M. Morrison, Tacoma, Wash., assignor to American Smelting & Refining Company, N. Y.

The device covered is a filter having a container to hold the solution to be filtered and in which is suspended a number of filter plates, each having a pair of filter surfaces. The cake is formed in the spaces between the plates by suction. A means is provided for applying mechanical pressure to this assembly of filter plates, when in raised position out of the tank, while maintaining the vacuum, so that a substantially dry and solid cake may be obtained.

COPPER METALLURGY. No. 1,679,337. July 31, 1928. John C. Moulder and Bruce Taplin, London, assignors to Metals Production Company of North America, Inc., New York.

A process for separating copper from gangue materials by heating the ore and mixing it with solid carbonaceous matter and in the presence of a haloid at a temperature lower than the melting point of copper and yet adequate to produce a reaction so that the copper is caused to come out of the ore particles originally containing it, and is found outside them in the metallic condition among the charge.

BULLETINS

TESTING CIRCUITS—Roller-Smith Company, 233 Broadway, New York. Bulletin No. 300, on portable, direct-reading, slide-wire ohmmeters. Eight pages.

STEAM PLANT—Heine Boiler Company and Ladd Water Tube Boiler Company, 200 Madison Ave., New York, published in the July issue of "The Safety Valve," an article by J. R. Hinman, entitled "Burning Wood Refuse for Fuel." Four pages, illustrated.

STEAM PLANT—The Superheater Company, 17 East 42d St., New York, Bulletin T-1, entitled "The Elesco Superheater for Power Plants." Comprises 56 pages.

WELDING—The Lincoln Electric Company, Cleveland, Ohio. Eight-page bulletin entitled "Automatic Arc-welding by the Electronic Tornado Process."

WELDING—Fusion Welding Corporation, 103d St. and Torrence Ave., Chicago. Fuzon arc welders. Four pages. The same company has also issued Bulletin No. 128 on the subject of the influence of carbon in steel welding rods. Four pages.

BLOWERS — The Connersville Blower Company, Connersville, Ind. Bulletin 17A, on rotary positive blowers for blower service requiring large capacities at low and medium pressures or suctions.

BALL MILLS—Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Bulletin 1813-C. Ball granulators. Forty pages.

TRACTORS—Caterpillar Tractor Company, San Leandro, Calif., and 50 Church St., New York. A 20-page pamphlet entitled "Caterpillar Power for Mines and Quarries."

NEWS OF THE WEEK

Summary

DISCOVERIES at North Lily and Eureka Lily, which enabled these two properties in the Tintic district of Utah greatly to increase their output, were the high lights of the first half of 1928 in that district. Other important developments, together with a detailed summary of shipment of ore and concentrates, will be found on page 228.

* * *

The new unit of the Noranda smelter, with a capacity of 800 tons a day, is expected to be in operation by the end of August, according to Toronto reports. This will put the total daily tonnage handled by Quebec's only copper smelter at 1,600 tons. Page 231.

* * *

Development of tin properties in Bolivia continues despite the prevailing low prices for the metal. American capital is actively engaged in this development. C. V. Bob has recently acquired a mine near Llallagua. Page 226.

* * *

At the meeting of Rhodesia Broken Hill in London it was disclosed that dividend payments must be postponed as the result of difficulties in connection with starting production at the new electrolytic zinc plant, which, it is claimed, can produce zinc at the lowest cost in the world. Page 231.

* * *

Electric power is now available at the Octave mine, in the Weaver district, Yavapai County, Ariz., for mining operations, which have just been resumed. Page 227.

* * *

Golconda Lead has joined the ranks of the producing mines in the Coeur d'Alene district of Idaho. The 200-ton mill was put into operation on Aug. 1. It cost $125,000. Page 230.

* * *

Installation of a flotation cell in the Champion mill of the Copper Range company marks the first step in the adoption of the flotation method, advocated by the U. S. Bureau of Mines, in the Michigan copper district. Page 230.

Increased Agitation for Export Tax on Chilean Copper

By Paul Wooton
Special Washington Correspondent

INTRODUCTION of legislation in the Chilean national legislature providing for an export duty on copper is imminent, according to reports received by the U. S. Department of Commerce. The same reports, however, state that the consensus of opinion in Santiago, the Chilean capital, is that such a proposal will be defeated if brought to a vote.

There has been an increasing amount of political agitation in Chile for the copper export tax. Prior to the difficulties which overtook the nitrate industry, as a result of the competition offered by synthetic nitrogen, this was urged on the ground that a valuable national resource was being drawn upon without due compensation to the Chilean people.

Since the government now must stand its share in meeting the competition which faces nitrate, a new argument is furnished for an export tax on copper. Indications are that sentiment for such a tax is much stronger than heretofore, but as only five weeks of the congressional session remain, it seems highly doubtful that legislation of such a controversial character can be put through. A considerable number of the 134 members of the Chamber of Deputies and of the 45 members of the Senate fear that the tax will result in a curtailing of the activities of the copper-producing companies, which just at this time would have a particularly bad effect on business, it is argued, as well as adding to unemployment.

Information also has reached Washington that American producers are now in a position to supply a considerable portion of the market now being served from Chile with copper produced in the United States. There is every reason to believe that an export tax would result in an important curtailment of activities in Chile and a corresponding increase in copper production in this country.

Power Plant at Empire Chief Is Completed

Carter Mines, Near Ohio City, to Be Reopened—Mill Erected for Chain'O Mines, at Central City

THE HYDRO-ELECTRIC plant of Empire Chief Mining, at Capitol City, Hinsdale County, Colo., has been completed and the concentrator is being prepared for production. Highland Chief mine will also obtain its power from the Empire Chief plant. Crews are being worked in the Chicago tunnel of the Empire Chief to supply the mill with ore, which in this district carries silver and lead. The holdings of the company total seven patented claims on Sheep Mountain, near Henson Creek. The property is situated 12½ miles from Lake City.

Near Ohio City, Gunnison County, Carter Mines is reopening its gold property. W. D. Murdie, superintendent of the company, is starting development of a new ore vein uncovered last fall. The 50-ton concentrating and flotation plant will be put into operation. Ore is silver-gold and is taken from several tunnels, totaling 8,000 ft. in length and a 1,400-ft. shaft. Power is obtained from a hydro-electric plant which generates about 100 hp.

Completion of the new mill of Chain'O Mines being constructed by the Ruth Roller Mill Company is expected to be completed soon. Plans have been made to have it operating early in October. The mines and mill of the Chain'O company are situated at Central City. J. M. Tippett, formerly superintendent of the Independence mill of Portland Gold Mines, is supervising the construction work.

An extension track is being built by the newly formed Colorado Mining Trust to connect its Midget mine with the railroad at Cripple Creek, Colo. Tramways will be erected from the Midget to the Anchoria-Leland and Conundrum mines, which were included in the recent consolidation by J. A. F. Durocher-Stone, of New York.

Oscar Hanno, a Denver mining engineer, and his associates are preparing to open the Anaconda mine, at Spencer, Gunnison County. This mine was originally operated in 1914 by Sanford Zeigler and Joseph Reiss, under the name of Colorado Copper Mining & Milling. The ore carries silver, gold, and copper.

Development of Tin Properties Continues in Bolivia Despite Low Prices

C. V. Bob Acquires Mine Near Llallagua—New York Engineering and Yuba Dredging Active on Placer Prospects—New Concentrator Being Erected by Monserrat Mining Near Poopo

DESPITE the prevailing low prices for tin, active development of several mines and prospects in the tin-producing districts of Bolivia is being undertaken, particularly by American capital. C. V. Bob, president of the Comstock Merger Mines, has acquired an option on the San Juan de Vila Apacheta tin mine, owned by Juan Dubravcic. If the option is exercised, it is said that the consideration will be £450,000. Intensive diamond-drill operations are being conducted to ascertain whether mineralization continues at depth. It is estimated that about 100,000 tons of ore, containing 6 per cent tin, has been put in sight. The property is situated about 15 miles east of the Patiño Tin mines, at Llallagua. As Mr. Bob is interested in the newly formed holding company known as Metal and Mining Shares, the presumption that this company may back the development of the San Juan mine is warranted.

Yuba Dredging, of California, has been drilling the Centenario tin placer, in Uncia. The ground is reported to be very deep, some of the holes reaching bedrock at a depth of 200 ft. The general average is said to be more than a pound of tin to the cubic yard.

New York Engineering, which also controls a dredging concession in Guatemala, has taken an option on the Huanuni tin placers and is drilling the ground. It is reported that these interests have proven about 20,000,000 cu.yd. of material carrying about 2 lb. of tin. The dredge produces a 15 to 20 per cent concentrate. This will be re-treated at a tin-dressing plant, which makes a 60 per cent concentrate. The tin is associated with pyrite, limonite, and blende.

Erection of a new 100-ton concentrator has been started by Monserrat Mining. It will be situated on the railroad between Pazna and Poopo. The ore will be transported to the mill from the mine by an aërial tramway. The ores of the Monserrat mine are said to present an interesting metallurgical problem, as about 50 per cent of the tin content is teallite—sulphide of tin. It is estimated that 200,000 tons of 5 per cent ore has been developed, which should furnish the mill with an ample supply of ore for several years.

At the property of San Vicente Mining, near Atocha, operations at the mill may be stopped and the plant changed over to flotation methods of treatment. At present it uses the Holt-Dern process, which has proved very expensive because of high power costs and a comparatively low recovery. The company treats silver ore. It is said that the San Vicente mill was the first plant to use the Holt-Dern process outside of the United States. Tintic Milling, a Utah plant which closed down in 1924, was the first milling company to use the process anywhere.

Frank M. Smith Seeks Market for Errington Concentrates

FRANK M. SMITH, smelter director of the Bunker Hill & Sullivan Mining & Concentrating, and representative of the Bradley interests, is in New York for several weeks, arranging for the marketing of the copper, lead, and zinc concentrates to be produced at the Errington mine of the Treadwell-Yukon company, one of the Bradley organizations, in the Sudbury district of Ontario. A 250-ton pilot flotation plant is now operating on the lower-grade ores from the west-end orebodies. This plant is to be followed by one of much larger capacity as soon as the ore reserves are completely defined.

Zinc and lead concentrates will undoubtedly be sold to European smelters. New York representatives of the more important European zinc and lead smelters are conferring with Mr. Smith during his stay in the East, although the contracts may not be awarded for several weeks. Zinc and lead concentrates likewise must be sold abroad, as the United States import tax on lead and zinc makes importation into this country out of the question. Copper concentrates will find a market at one of the plants on the Atlantic seaboard, in all probability.

Monthly concentrate production at the Errington mill at present is 100 to 150 tons of 15 per cent copper concentrates; 100 to 150 tons of 50 per cent lead concentrates, and 750 tons of 48 to 50 per cent zinc concentrates. Concentrate output of the present plant will be increased as soon as the higher-grade ores from the east-end orebodies become available.

Oromonte Mill Completed at Silver Peak, Nev.

THREE lots of ore have been tested at the new 75-ton mill of Oromonte Mining at Silver Peak, in Esmeralda County, Nev., and recoveries ranging from 93 to 96 per cent have been effected. The company is developing the old Valcalda gold property, situated 9 miles from the mill. Three seven-ton trucks are hauling the ore from the mine to the mill.

Ore is hoisted to the top of the mill, after which gravity suffices for conveying. The mill is equipped with a Hardinge conical ball mill, amalgamation plates, Deister-Overstrom tables, and Kraut flotation cells. An abundance of water is available for operations and electric power is also available.

At the mine, development has proved satisfactory. In addition to the mill ore blocked out in the old mine workings, a new find has been made in virgin ground, several hundred feet south of the mine. A face of quartz, 12 to 14 ft. wide, has been exposed. The ledge crops for a distance of 500 ft.

The Franchini mill, at Silver Peak, is running steadily on ore from the Mary mine, operated by Lucky Boy Divide. With these two mills in operation, the old town of Silver Peak has taken on new life.

Forty Scientists in the Field for U. S. Geological Survey

FORTY or more scientists of the Geologic Branch of the U. S. Geological Survey, with their assistants, are now scattered throughout the United States, making those field studies that serve as a basis for determining the probable mineral character and value of the public domain which remains under the care of the Department of the Interior and that furnish other geologic information of use to the public. The greater part of this geological work is in the Western states, where interest in mineral resources is keener than in the East and where the government is more directly concerned because of its ownership of large bodies of public lands.

Four geologic groups are in the State of Montana. Two of these, under the direction of geologists experienced in the field of metals, are conducting surveys in the region tributary to Helena.

In central Idaho one geologic party is studying the deposits of metals which are associated with the great granite intrusions of the central part of the state.

In Nevada three areas are under examination—one, the Charleston Peak region west of Las Vegas; another, the Ivanpah region immediately to the south; and a third, the Silver Peak area west of Goldfield.

In northern California, in Plumas County, an examination of the copper deposits is under way. This is being conducted by one of the experienced geologists of the Survey staff who is also a member of the faculty of Yale University.

In southeastern Utah systematic work is being done along the canyons tributary to the San Juan and the Colorado. This investigation will extend westward to include Navajo Mountain.

In Colorado an extensive co-operative project, begun two or three years ago, is being continued energetically. The expenses of this work are shared between the state and the U. S. Geological Survey.

In addition to the co-operative work on the state map in Arkansas, another co-operative project there involves the study of possible lead and zinc deposits.

Howe Sound Increases Capacity of Britannia Mill

Premier Gold May Mine and Mill Woodbine Gold Output to Supplant Its Own Ore

CAPACITY of the Britannia mill of the Howe Sound Company, at Howe Sound, B. C., has been still further increased, and now it is treating approximately 5,000 tons daily. The mill was built in 1921, and had a rated capacity of 2,000 tons daily, a tonnage which it soon outstripped. Additions of coarse-crushing machinery at the bottom of the raise from the main haulage tunnel, through which all the ore passes, and of fine-crushing machinery and flotation cells in the mill building, from time to time, have raised the mill to its present capacity. Milling costs have been reduced to less than 40c. per ton, and the copper content of the tailing to less than 0.11 per cent. The mill makes two products, a copper concentrate, averaging around 21 per cent of copper, and an iron pyrite concentrate, averaging around 49 per cent of sulphur.

Premier Gold Mining completed a thorough sampling of the Woodbine Gold Mining property, which in places adjoins the Premier, in the Portland Canal district, on July 19. Though no official statement has been issued by either company, it is understood that the Premier company made the sampling to enable it to make an offer to mine and mill the Woodbine ore on a cost-plus basis, similar to that made to and refused by B. C. Silver Mines, and not with a view to acquiring the Woodbine property, on which a considerable tonnage of milling ore has been developed.

It is no secret, of course, that the Premier mine cannot provide the mill with feed for much longer than another two years, and the Premier company wisely is searching for ore to supply the mill and give employment to the staff of skilled experts after the Premier mine has been exhausted. In this connection, it is noted that at the annual general meeting of Selukwe Gold Mining & Finance, held in London on May 21, the chairman, Cromwell Hockley, stated that when the development now under way at B. C. Silver mine is completed, the directors would advocate a rapprochement between Selukwe and Premier, either on a co-operative or sale or purchase basis. Selukwe controls 58 per cent and Premier owns 38 per cent of the stock of B. C. Silver Mines.

Though no official statement has been made, it is understood that the Premier engineers, after they had sampled B. C. Silver mine, late last year, reached a considerably lower estimate of the tonnage and value than the 466,000 tons, having a gross value of about $6,500,000, estimated by B. C. Silver engineers, and that the latter were anxious to open by winze and drifts some of the ground in dispute, the extent and value of which had been indicated by diamond drilling. A development winze is now being sunk.

Reverting to the Woodbine company, Charles E. Hutton, representing the English interests in the company, and J. B. Watson, president of the company, now are at the mine for the purpose of making an exhaustive examination. When this has been done, Captain Hutton will examine the Whitewater mine, in the West Kootenay district, and the Pend Oreille mine, in the northeastern part of the State of Washington, in which he and his English associates are interested.

Florence Goldfield Purchases Cleveland Gold Mine

Florence Goldfield Mining, of Goldfield, Nev., has purchased the Cleveland gold mine, in the Bullychoop district in Shasta and Trinity counties, Calif. Kirby Thomas, president of Florence Goldfield, states that a cash payment was made and that the Florence company will spend $50,000 on new equipment. Florence California Mining has been organized to work the Cleveland.

Grandview Mines Acquires Z-Canyon Property

HOLDINGS of the Grandview Mines Company at Metaline Falls, Wash., were substantially increased on July 27, when arrangements were completed whereby the company acquired control of the adjoining Z-Canyon property. Development of the lead-zinc orebodies of the company is progressing satisfactorily, and large-scale extraction operations are expected to begin about Oct. 1, when construction of the new 1,000-ton flotation mill now being erected will be completed. New development work begun at the property includes the driving of an 8x9-ft. tunnel to cut the ore zone at a distance of 1,300 ft. The portal of the tunnel is just above the ore bins. This arrangement will provide a suitable system of gravity transportation of the ore from the mine to the mill.

Indian Copper Corporation Developing Mosaboni Mine

The Indian Copper Corporation, Ltd., is carrying on some interesting work in developing and equipping its Mosaboni mine. According to last reports more than half a million tons of ore averaging close to 4 per cent copper has been proved, for which mining, concentrating, and smelting equipment is to be provided. The main incline shaft of the mine is being equipped with reinforced concrete and steel, and reinforced concrete storage bins are being provided to deal with an initial output of 400 tons a day. It is expected that production will be reached in six months' time. Mr. R. B. Woakes is general manager, his address being Mosaboni P. O., District of Singhbhum, Chota Nagpur, India.

Arizona Power Line Extended to Octave Mine

U. V. X. Fails to Find Extension of Oreshoot—Company Formed to Treat Old Dominion Dump

POWER is now available for operations at the Octave mine, in the Weaver district, Yavapai County, Ariz., as a result of the extension of the power line of Arizona Power from Constellation to the mine. The line was only recently extended to Constellation from Tapco. The Octave mine is being reopened and a new 50-ton mill is being installed by R. H. Clark, of the Mill Equipment Company. It will supplant an old 40-stamp mill and cyanide plant that was formerly operated in conjunction with the mine by Octave Mining & Milling.

At the time that the Octave property was closed, a few years ago, the management claimed that 40,000 tons of gold ore was in sight. Development has reached a depth of 2,000 ft., with most of the ore showing on the 800 level.

A company has been formed to convert the slag dump at the Old Dominion at Globe, Ariz., into bricks, road material, and other useful products. Slag Paving Brick & Products is the name of the new company. Erection of a $250,000 plant at the dump is planned. Papers filed with the state corporation commission put the capital of the concern at $750,000. It is hoped to begin manufacture of the slag products within four months.

Developments at Wright Creek and Superior

Fifteen miles east of Hackberry, on the Santa Fe railroad, in Mohave County, Ariz., Wright Creek Mining is reported to have struck some good ore in the Wallapais Mountains. About 1,300 ft. of new development work has been done at the property, known as the American Flag. The ore carries gold, silver and copper.

At Superior, Belmont Copper Mining is continuing to explore the territory to the east of the shaft. Exploration is being conducted both by crosscutting and diamond drilling. It is hoped that copper orebodies will be developed at depth, beneath the earlier surface showings. Productive operations are now yielding gold-silver-lead ore, with a negligible copper content. The concentrates from the 50-ton mill at the mine are being treated at the nearby Magma smelter.

United Verde Extension reports that the persistent development work done under the Verde fault at its mine near Jerome indicates that no continuation of the remarkable oreshoot, found beneath the leached quartz and gossan of the Little Daisy shaft development, can be expected within the company's territory. The policy of investigating and developing prospects and mining properties at Jerome and elsewhere will be continued. Copper production during the second quarter of 1928 was maintained in excess of 1,600 tons a month.

Property of the Tintic Standard Mining Company at Dividend, Utah. No. 1 shaft at extreme left; No. 2 shaft and ore bins in the center, and townsite in the foreground.

Discoveries, Exploration, and Development Mark Tintic District in First Half of 1928

Output of North Lily Almost Double That for Previous Year, and Eureka Lily Becomes Steady Shipper—Production Records of Other Tintic Producers

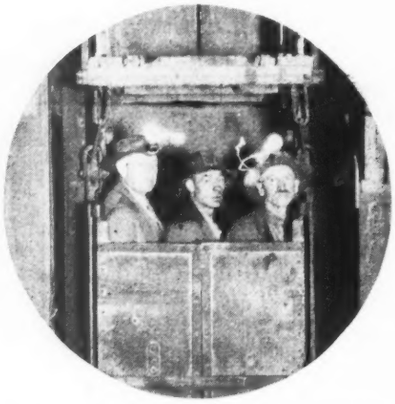
By H. D. Keiser
Assistant Editor

THOUGH shipments of ore from the Tintic district of Utah during the first half of 1928 decreased 17 per cent, compared with those for the same period of 1927, concentrate shipments, which were made solely by Chief Consolidated, increased 60 per cent. Statistics furnished by the companies operating in the district show that for the two periods the following tonnages were sent to the smelters: First half of 1928, 162,450 tons of ore and 4,938 tons of lead concentrates; first half of 1927, 195,201 tons of ore, 2,206 tons of lead concentrates and 912 tons of zinc concentrates.

Outstanding among the important developments in the district this year were the increased interest taken in the search for new orebodies in both unproved areas and those formerly productive, and the growth in the output of the North Lily and Eureka Lily mines. Production from North Lily practically doubled, and Eureka Lily, which was undergoing the first stages of development last year, became a steady shipper and one of the most promising new properties in the district.

Output of Tintic Standard, the largest producer in the district, declined 4½ per cent in tonnage this year, 59,238 tons of ore being shipped by the company, compared with 62,210 tons for the first half of 1927. From the Colorado property, which Tintic Standard controls, a total of 7,799 tons of additional ore was sent to the smelter in 1928. Of this quantity, 7,606 tons was low-grade non-commercial ore obtained in cleaning up the property preparatory to development. The remaining 193 tons was produced by leasers.

Chief Consolidated maintained shipments at practically the same rate as during the 1927 period; 47,577 tons of ore and 4,938 tons of lead concentrate were sent to the smelters this year, compared with 47,539 tons of ore, 2,206 tons of lead concentrate and 912 tons of zinc concentrate for the first half of last year. A considerable portion of this year's output, however, was from a new source—namely, the Eureka Lily property, where the company has recently expanded operations.



Left to right—T. P. Billings, manager of mines; Thomas J. Franks, cage rider, and William Owens, superintendent of mines, in a cage at the 2,000 level of the Eagle and Bluebell main shaft of the Bingham Mines Company.

Properties of the Bingham Mines Company this year shipped 21,855 tons, of which 12,648 tons was mine ore and 9,207 mill tailing. This figure represents a decrease of 4½ per cent compared with 1927, when 22,866 tons were shipped during the six-month period. Ore produced this year was also slightly lower in grade than that mined in 1927. Considerable prospecting is being done in the eastern section of the company's Victoria property, in the hope of finding an extension of the Plutus run of ore. This work has already met with some success 160 ft. below the 1,300 level, where ore with the characteristics of the Plutus orebodies has been encountered in a winze from the level. In the Eagle and Bluebell mine, a number of extensions of orebodies, formerly stoped in the central and south portions of the property, have been explored between the 1,200 and 1,875 levels, and recently an extension of the main lead-silver run of ore, trending northwest, was disclosed on the 1,350-ft. level.

Discoveries of new ore occurrences have followed one another in rapid succession at the North Lily property this year. During the last few months these have been confined to the 900 level, where development is being concentrated. Ore has been encountered at three points on this level; first, in two sections of the development workings about 600 ft. northwest of the shaft, and just recently in a crosscut heading 100 ft. from the west side line of the property. Shipments from the North Lily totaled 14,801 tons for the first six months of 1928, compared with 7,654 tons during the same period of 1927.

The greatest decline in output among the properties in the district was that registered by Mammoth Mines, with a production of 6,603 tons this year against 17,953 tons for the first half of last year. Properties controlled by the Knight interests—namely, Empire Mines, Dragon, and Swansea—shipped 853 tons during the first six months of 1928, and 704 tons the first half of 1927. Leasers at the Mountain View produced 692 tons, against 716 tons for

1927. The Alaska mine, of the Bamberger interests, shipped 343 tons this year, and the Gold Chain 461 tons, no shipments being made from either property in the 1927 period. American Smelting & Refining continued with shipments from the Mammoth dump; only 2,228 tons was loaded this year, compared with 35,559 tons the first half of 1927. Approximately 6,000 tons remains to be shipped from the dump.

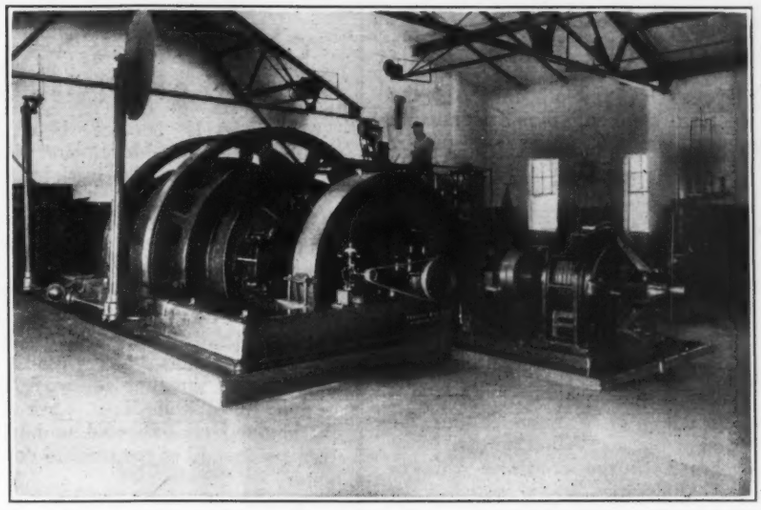
Shipments from Tintic District

Properties	First Half 1927 (Dry Tons) Crude Ore	Concentrates	First Half 1928 (Dry Tons) Crude Ore	Concentrates
Tintic Standard	62,210	.....	59,238	.....
Chief Consolidated	47,539	(a) 3,118	47,577	4,938
Bingham Mines	22,866	.....	(b) 21,855	.....
North Lily	7,654	.....	14,801	.....
Mammoth Mines	17,953	.....	6,603	.....
Mountain View	716	.....	692	.....
Empire Mines	604	.....	611	.....
Dragon	85	.....	127	.....
Swansea	15	.....	115	.....
Alaska	.....	.....	343	.....
Gold Chain	.....	.....	461	.....
Colorado	.....	.....	(c) 7,799	.....
Mammoth Dump	35,559( )	.....	(d) 2,228	.....
Totals	195,201	3,118	162,450	4,938

(a) Includes 912 tons of zinc concentrates.
(b) Includes 9,207 tons of mill tailings.
(c) Includes 7,606 tons non-commercial ore from clean-up of mine preparatory to development.
(d) Shipments of tailing by American Smelting & Refining Company.

Mining Man Accidentally Kills Himself

J. J. Blackie, mining engineer, of Hollister, Calif., was accidentally killed on July 25 by a shot in the stomach from his own automatic gun. When he leaned over to switch on a light at his own home, Mr. Blackie accidentally touched the holster of the gun, hanging on the wall. It fell and was discharged, the bullet entering Mr. Blackie's ribs. He died the following day. J. J. Blackie was a Scotchman by birth, but came to California in 1908.



Ottumwa electric hoist at the main vertical shaft on the Eagle and Bluebell property of the Bingham Mines Company. Both the Eagle and Bluebell and Victoria properties of the company are served by this shaft, which has three compartments and is 2,018 ft. deep. A 300-hp. Westinghouse motor operates the hoist

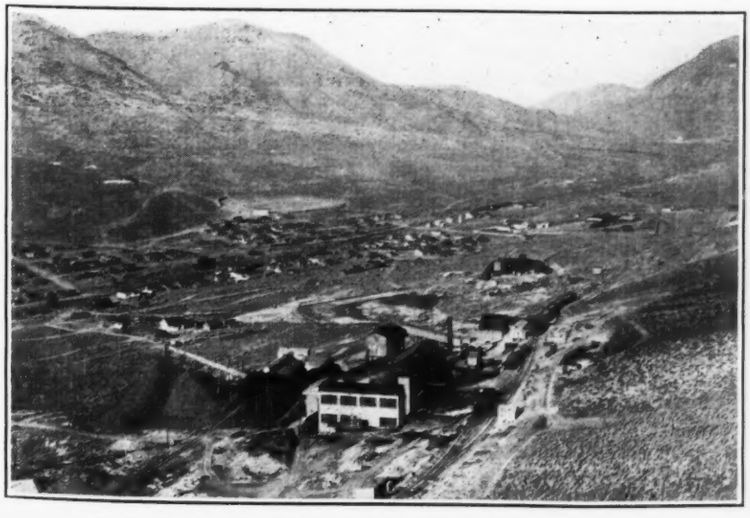
Altar Cananea Shaft Will Be Sunk Additional 500 Ft.

ALTAR Cananea Mining, which owns the Copper Prince group, 6 miles south of the Mexican border and about 70 miles west of Nogales, Ariz., is planning an active development campaign. The main shaft will be retimbered and will be sunk from its present depth of 220 ft. to 720 ft. Present hoisting facilities allow operations to a depth of 1,000 ft. Crosscutting from the 720 level will be undertaken to determine whether the several veins that are indicated by outcrops come together to form one large deposit at depth. Dr. Frank T. Hogeland, of Cananea, is president of the company. Other officers are George Young, secretary-treasurer; William Catron and B. E. Leonard, directors; and David Gough, in charge of operations.

President Coolidge Visits Mesabi Iron Range

ON AUG. 2, President Coolidge visited the great Hull Rust mine of Oliver Iron Mining at Hibbing, Minn., in company with Pentecost Mitchell, president of the Oliver company; William A. McGonagle, president of the Duluth, Mesabi & Northern Railway; and Horace Johnson, president of the Duluth & Iron Range Railway. This was the first trip the President had taken since he established the summer capital at Superior, Wis. In Hibbing and in Virginia, Minn., all business activities were stopped for the day in honor of the President, but the mines were kept working. In addition to the Hull Rust, which is the largest open-pit mine in the world, Mr. Coolidge visited several other Mesabi mines.

Volatilization plant and mill of Chief Consolidated Mining Company at Eureka, Utah. Experimental mill of the company is seen in the center of the view.



New Mill of Mohave Mining Nearing Completion

Construction of the new 300-ton mill being erected by the Mohave Mining Corporation at Twin Falls, Mont., is rapidly nearing completion. Equipment to be installed for treating the gold-quartz ore mined at the property includes an 8x6-ft. Marcy ball mill, 6x22-ft. duplex Dorr classifier, 8x6-ft. Oliver filter, and a 10x20-ft. Dorr thickener. This equipment is being supplied by the Eastern Iron & Metal Company of Salt Lake City. Operations at the property are under the direction of J. V. Priest, general manager.

Silver Chief Incorporated

The Silver Chief Mining Company was recently incorporated in Spokane by Spokane men to develop property near Colville, Wash. The incorporators are H. G. Carey, A. J. Palmquist, C. H. Blake, Percy Stanley, and John Goody. The capitalization is $149,000.

Mammoth Gold Property to Be Operated by Apache Trail

THE OLD Mammoth mine, at the western edge of the Superstition Mountains, about 25 miles east of the town of Mesa, Ariz., will be operated by Apache Trail Gold Mining, which has been organized by former stockholders in the Young Mines Company. The Mammoth mine was supposedly exhausted about 35 years ago, when it was operated by Sullivan & Hall, of Denver. Later George U. Young, at one time territorial secretary of Arizona, took the mine over and organized the Young Mines Company, spending about $500,000 of Eastern capital for development work. When he died, several years ago, the company was in financial difficulties. Subsequently a group of Pennsylvania stockholders, represented by H. A. Severinghaus, of Phoenix, Ariz., bought the property. These stockholders have now formed Apache Trail Gold Mining, and T. H. Mansfield has been put in charge as superintendent. He is exploring the northern edge of the 1,600-acre tract that comprises the holdings.

The mine contains a large, disseminated low-grade orebody and carries free-milling gold. Three shafts have already been sunk, one of them to a depth of 1,200 ft. A 100-hp. hoist and a 900-cu.ft. compressor were installed when Mr. Young took charge.

Copper Range Will Install Flotation Machine

COPPER RANGE has ordered a Fahrenwald flotation machine for its Champion mill, in the Michigan copper district. It will be tested to determine whether it is the right size and type to suit the company's needs. This step is a direct result of the investigations by the U. S. Bureau of Mines, under the direction of A. W. Fahrenwald, into the possibilities of the use of flotation in the treatment of the native copper ores of Michigan. If successful, the entire mill may be changed over to the flotation method.

New Work at Arcadian, Quincy, and Champion Copper

Development work in Arcadian Consolidated consists in driving crosscuts both east and west from the bottom of the New Baltic shaft at the 1,700 level. The west crosscut, which is already in 130 ft., is expected to tap the vein 150 ft. further west.

At Quincy, No. 6 shaft has been sunk to the 88 level. Crosscutting to the vein and drifting will soon be under way. The 87 level continues rich in copper in the main vein.

It has been announced that the E. J. Longyear Company, of Minneapolis, will do the diamond drilling for Champion Copper in the 5,000 acre tract turned over to the company by Copper Range and St. Mary's Mineral Land for exploratory purposes. Two drills will be used at the start.

Great Falls-Salt Lake Air Service in Operation

AIR MAIL service between Great Falls, Mont., and Salt Lake City, Utah, was initiated by National Park Airways, Inc., on Aug. 1. Traffic was so heavy on that day that two planes were operated in each direction to carry mail, express, and passengers. The service also includes Helena and Butte, Mont., and Pocatello, Idaho. As this new service cuts the time for mail between Butte and New York by 36 hours, it is expected to be of tremendous aid to the mining companies in the district.

New 200-Ton Mill of Golconda Lead Is Started

ON AUG 1, the new 200-ton flotation mill of Golconda Lead, two miles east of Wallace, Idaho, in the Coeur d'Alene district, was put into operation. The plant was designed by M. P. Dalton, mill superintendent of Federal Mining & Smelting, and cost $125,000. According to W. A. Beaudry, managing director of the company, the raise from the 800 level was recently completed to a tunnel at the 300 level. This raise will provide ventilation and permit operations above the 800 level. Crosscuts will be driven to the vein at intervals of 200 ft.

Herman J. Rossi, president of Jack Waite Mining, states that the remodeled concentrator of the company, also situated in the Coeur d'Alene district, is making a recovery of 93 per cent of the metallic content in the ore. This plant resumed operation in the middle of July and is now operating at capacity, or about 250 tons a day. Returns from the Bunker Hill smelter show a content of 65 per cent lead, 6 oz. of silver, and $2 in gold to the ton of concentrate.

Three New Minerals Discovered at United Verde

VERIFICATION of the fact that three minerals discovered in the shaft of the United Verde Copper Company at Jerome, Ariz., are new was made by measurements of the crystals and determination of the optical properties. According to Carl Lauson, field geologist, and formerly connected with the U. S. Bureau of Mines at Tucson, Ariz., the new minerals are the result of the fire which has been burning in the mine for a number of years. They have been named "butlerite," "guildite," and "ransomite," respectively, after three members of the faculty of the University of Arizona at Tucson. Two other new minerals recently found have been named "jeromite" and "louderbackite," the latter in honor of Dr. George L. Louderbacke, professor of geology of the University of California.

Dredging Operations Extensive in Alaskan Districts

ALASKA Consolidated Gold, which has acquired extensive holdings on the Forty Mile River and its tributaries, Dome, Chicken, Mosquito, and South Fork creeks, is arranging to operate two hydraulic plants and a dredge. The Goldstream dredge of Fairbanks Exploration was the first of the company's fleet of new dredges to go into operation. It started activities on June 30. The Cleary Creek dredge started to handle ore last week. The third dredge, which will be located on the Chatanika River, should be ready before the close of the season. A fourth dredge will probably be started in the spring of 1929. U. S. Smelting, Refining & Mining controls Fairbanks Exploration.

Tanana Valley Gold Dredging, which is financed by British capital, is operating its dredge on upper Fish Creek, and plans to place another on Engineer Creek. The Fish Creek dredge was completed in September, 1925, and started work in the spring of 1926. It is a 5-cu.ft. bucket installation.

The Livengood placer camp is extremely active this year. Eight properties, in all, are being operated steadily. It has been suggested that the Alaska Road Commission provide better transportation by building a road from Fairbanks or Cleary to the camp, as facilities at present are very poor.

McMillan Gold Inspected With View to Expansion

A PARTY of prominent financial and business men of New York will visit the property of McMillan Gold Mines, Ltd., next week in connection with plans to extend the present scale of operations materially, preparatory to installing a mill on the property. It is situated in Mongowin Township, in the Sudbury district of northern Ontario, about two miles from West River, a station on the Algoma Eastern Railway. The party will include some of the directors and stockholders of the company. Dr. John H. Banks, consulting engineer and president of the company, will join the party at the mine.

Some diamond drilling was done at the property last year, and a shaft was sunk to a depth of 550 ft. It is reported that results on the 325 and 525 levels have been sufficiently satisfactory to the management to encourage the enlarged operation and increased equipment now being considered.

Strike Reported at Hyder

A sensation has been created among prospectors in the Hyder district in southeastern Alaska, adjoining the Portland Canal district of British Columbia, by the discovery of float said to assay high in silver and gold content. It was found on the Marietti group, on the west fork of Texas Creek. The country in the neighborhood is being scoured in an effort to find the source.

Toronto Letter

By Our Special Correspondent for Northern Ontario

New Unit at Noranda Smelter Expected to Be Operating by End of August

TORONTO, AUG. 4, 1928—The second unit of the Noranda smelter, in the Rouyn district of Quebec, is expected to start operating by the end of August. The additional capacity will raise the tonnage treated to about 1,600 tons daily. Ore is now being handled at the rate of 800 tons a day. Good progress is being made with the construction of the concentrator to treat the comparatively low-grade ores. The grade now being treated by the smelter is said to be more than 8 per cent copper, with the gold content showing a considerable increase over the earlier recoveries.

IT HAS been definitely decided to sink a new shaft at this property, but the location is not yet determined. This addition to the workings is regarded as necessary not only to provide an outlet for the larger tonnage which will be required to operate the enlarged smelter, but also to insure safety against fire hazard. Development work on the 400 level has shown high-grade ore in the so-called "B" orebody, which is said to average 12 per cent copper. The gold content in the "H" orebody, the discovery of which on the 980 level recently sent share values of Noranda soaring, continues to show greater value than in any other part of the mine. A zone parallel to the main orebody has been discovered carrying $8 in gold and averaging 20 ft. in width.

At the Wright-Hargreaves gold mine, in the Kirkland Lake district of Northern Ontario, both the shafts are nearing the 2,000 level, at which they will be bottomed. On reaching this depth, a transformer, a pumping station, and a loading pocket will be established at the south shaft and a crosscut will be driven to connect them. The shafts are 500 ft. apart. When the crosscut is completed, two new levels will be opened up simultaneously, at depths of 1,875 and 2,000 ft. Drifting is now being effected on the lower levels toward the Lake Shore boundary. Preparations are being made for stoping on the 1,750 level. It has been discovered that there are two veins, and not one vein, as had previously been believed, in the northern section at the lower levels. The second vein has been proven from the 1,250 to the 1,750 level. Tonnage handled at the mill is averaging about 700 tons daily, but mill heads have varied. Recovery is said to be improving.

Justice Raney, at Toronto, has ordered liquidation of the business of the Jury Gold Mine Development, a Kirkland Lake company organized in 1925. The company was capitalized at $2,000,000. Directors of the company sold the stock at low prices, but no attempt was made to develop the property, which consisted of two claims.

Recent developments at the 2,850 level of Kirkland Lake Gold, in the Kirkland Lake district, have brought the average grade of the ore on that level to a point substantially higher than the average in other parts of the mine.

Mexico City Letter

BY W. L. VAIL
Special Correspondent

Mexican Zinc Output Showed 20 Per Cent Increase in First Half of 1928

MEXICO CITY, MEXICO, July 28, 1928.—Although the production of gold in Mexico decreased slightly during the first six months of 1928, there have been slight increases in the production of lead, silver, and copper, and the data show an increase of about 20 per cent in the production of zinc. Retirement of the heads of the Department of Commerce, Industry and Labor will not affect the personnel of the organization, according to report.

In a statement regarding the situation at the close of the half year, Señor Ortiz, head of the mining department, pronounced it normal. There have been no untoward incidents in exploitation, exploration, or management of important properties. The closing down at the San Juan Taviche mine, in Oaxaca, which is controlled by American Smelting & Refining, was caused entirely by the fact that the limit of the exploration program had been reached.

AUTHORITIES are investigating the causes of the recent bomb explosion at the Erupcion mine, at Los Lamentos, State of Chihuahua. A considerable quantity of valuable machinery was wrecked by the explosion. The property, an important silver-lead producer, is controlled by Ahumada Lead.

Reports from the State of Durango indicate general inactivity. In the Guanacevi district, the San Rafael is employing only a few men, although some new deposits of low-grade mill ore were recently discovered. The ore contains silver and gold. The Paleros mine, in the same district, recently sunk its shaft an additional 100 ft., but results have not come up to expectations and operations have been suspended. The Mexicana group, operated by General Elizando, has also practically shut down, although a few men have been retained for development work.

Recent reports from Temascaltepec, State of Mexico, state that the old Maravillas mine will soon be reopened by an American concern and that construction work on a small treatment plant has already started. It is expected that the property will be operating by November.

London Letter

BY W. A. DOMAN
Special Correspondent

Rhodesia Broken Hill Claims Lowest Zinc Production Costs in the World

LONDON, JULY 24, 1928.—Yesterday's meeting of the Rhodesia Broken Hill Development Company was full of interest. Sir Edmund Davis, the chairman, made several important announcements, and though shareholders were evidently pleased with some of them, they were unquestionably disappointed at the delay hinted at in connection with dividend payments. Apparently these will be postponed because of difficulties in connection with the starting of production at the plant and because of the necessity for new capital to increase the hydro-electric power plant. The company claims to produce zinc at the lowest cost in the world and also that the starting of its new electrolytic plant marks the first time that zinc-silicate ore has been electrolytically treated on a large scale.

I HAVE just had a talk with an engineer who returned recently from Nigeria. He states that the people in Nigeria are rather disturbed at the price of tin, which is considered low. Several of the companies, particularly those producing only 15 or 20 tons of concentrates a month, cannot make profits large enough to pay dividends, and he believes that such companies will soon be forced either to close down until the price improves or to be swallowed up by larger undertakings.

Union Minière's ore reserves at the end of 1927 are put at 78,491,000 tons, averaging 6.93 copper, an increase over the figures at the end of 1926, despite the fact that more than 1,700,000 tons was mined last year. The figures in 1926 were 77,160,650 tons, averaging 6.89 per cent copper. This gives a total metal content at the end of 1927 of 5,439,000 tons, compared with 5,317,853 tons at the end of 1926.

Tanganyika Concessions, which is associated with Union Minière, is continuing prospecting work along the Nile Congo divide and the Uganda concessions. The company has acquired an additional area of 12,000 square miles in the eastern province of Uganda, which is being examined by an expedition sent for the purpose.

Will Build 100-Ton Mill at Ivanhoe Group

J. C. Snell and E. J. Sich, of Los Angeles, have bonded the Ivanhoe group of claims, in the Dale district, San Bernardino County, Calif. A 100-ton concentrating plant will be built to handle the ore, which carries gold. Dry concentration is planned, because of the scarcity of water.

Personal Notes

AUTHUR W. JENKS, of San Diego, Calif., is engaged in professional work in Colorado.

F. W. MCLENNAN, manager for Miami Copper at Miami, Ariz., is in New York on a short business trip.

ANDREW W. NEWBERRY will return to New York about Sept. 1 after an absence of two years in Africa.

J. G. MACDONALD, general manager of the Goldfields Rhodesia Development Company, left Cape Town for England on June 29.

WILL H. COGHILL, supervising engineer of the ore-dressing department of the U. S. Bureau of Mines, is in Leadville, Colo.

J. K. TURNER, mine operator, of Los Angeles, is spending several days in Goldfield, Nev., attending to his various mining interests in that district.

F. R. KOEBERLIN, mining geologist, of Santiago, Chile, arrived in New York on July 31. Mr. Koeberlin will spend several months in the United States.

MILLARD K. SHALER, of Brussels, Belgium, was on July 4 the recipient of the honorary degree of doctor of engineering, conferred by Louvain University.

J. FRANK JONES, who is engaged in the development of a mining property in the Huachuca Mountains west of Bisbee, Ariz., is in New York for a week or two.

S. F. SHAW will leave for Rumania on Aug. 31, to engage in air-lift work for interests connected with the Standard Oil Company of New Jersey for the next two or three months.

E. N. GOODLETT has resigned from the Silver Leaf Metals and the Red Raven Gold in order to devote all his attention to the affairs of Gold Crescent Mines, of which he is manager.

J. F. GEARY, consulting mechanical and metallurgical engineer, of Salt Lake City, has returned to his headquarters there after ten months at Nome, Alaska, where he was engaged on professional business.

C. MINOT WELD, of Weld & Liddell, consulting engineers, has been appointed a member of the advisory committee of the Natural Resources Production Department of the U. S. Chamber of Commerce.

O. E. KEOUGH, metallurgical engineer with International Smelting, has been transferred to the company's plant at Tooele, Utah. Mr. Keough was formerly in charge of the Rico (Colo.) plant of the company.

JAMES A. MOORE, chairman of the board of the Genii Mining Company, developing a placer property near Magalia, Calif., is in New York in connection with the listing of the stock of the company on the New York Curb.

H. H. YUILL is in British Columbia, directing the operations of the Victoria Syndicate, Ltd., the exploration unit of the Mond Nickel Company, and the Central Mining & Investment Corporation, with headquarters at Kaslo, B. C.

GEORGE W. SWANSON has been appointed professor of electrical engineering at the Michigan College of Mining and Technology at Houghton, Mich. He has taught electrical engineering at the University of Minnesota for the last ten years.

A. F. CARPER, who has been superintendent of Stratton Cripple Creek Mining & Development in the Cripple Creek district of Colorado for the last four years, has resigned. He will devote his time to the development of some mining properties in Mohave County, Ariz.

Dr. G. F. LOUGHLIN, geologist in charge of metalliferous geology for the U. S. Geological Survey, was a recent visitor to Denver, where he conferred with C. W. HENDERSON, district engineer of the U. S. Bureau of Mines, and B. S. BUTLER, who is in charge of the governments ore-finding survey in Colorado.

HERBERT W. FOX, government mining engineer, Prussia, Germany, is in the United States studying health and safety methods employed in the mining industry. Mr. Fox was in the Salt Lake district from July 24 to 29. With DR. ARTHUR L. MURRAY, district surgeon of the U. S. Bureau of Mines, he inspected several mining and milling plants situated there.

H. A. OAKS, aërial director for Northern Aërial Minerals Exploration, recently flew from New York to Fort McMurray, Alberta, in a seven-ton Fokker plane on his way to the McLeod "mystery" mine. He was accompanied by eight prospectors, including CHARLES MCLEOD, whose two brothers were killed 24 years ago, supposedly for extracting gold from the mine.

DR. ARTHUR L. MURRAY, district surgeon of the U. S. Bureau of Mines, left his headquarters at Salt Lake City on July 31 on mine rescue car No. 9 of the Bureau for Butte, Mont., where he will confer with district mining officials concerning the International First-Aid and Mine Rescue Contest to be held there Aug. 20-22. HUGH B. MCDERMOTT, foreman miner with car No. 9, will proceed to Great Falls and Anaconda to train teams of the mining companies there for the contest, and C. O'CONNELL, first-aid miner, will train teams in the Coeur d'Alene district.

DR. GEORGE OTIS SMITH, president of the A.I.M.E., who has just returned from a Western trip, reports that he was much impressed with the increased and diversified demands for metal resulting from various recent inventions and developments. For instance, he spent a day at the Hawthorn plant of the Western Electric Company at Chicago, as a guest of the company's metallurgists. Large consumption of various metals is noted at this plant because of a nation-wide demand for the "talkies." The equipment necessary to the facilities of the motion pictures of the country amounts to a very large aggregate.

WALTER W. BRADLEY has been appointed state mineralogist of California to succeed LLOYD L. ROOT, who has resigned to enter private practice as a consulting engineer. Mr. Bradley has been a member of the staff since January, 1912, advancing through various positions to that of deputy state mineralogist, which he has occupied for the last five and a half years. He is a graduate of the college of mining at the University of California, receiving his degree in 1901. He is the author of a number of reports and bulletins issued by the State Mining Bureau, the best known being Bulletin No. 78 on "Quicksilver Resources of California," Bulletin No. 79 on "Magnesite in California," and the annual reports on the state mineral production from 1916 to 1927 inclusive.

An Appreciation of D. M. Riordan

THE WORLD was poorer in friendship when Dennis M. Riordan died, and mining men the world over will mourn his passing. Eighty is an age when the spirit of man has commonly lost the warmth and freshness of youth. Not so with Riordan—to the last he was the same lovable, sympathetic soul that we first knew in Bodie fifty years ago. He was unwearied in doing kindnesses. "Were every one to whom he did some loving service to bring a blossom to his grave, he would sleep beneath a wilderness of flowers." A letter from Riordan was a benediction that never failed to uplift the spirit of the recipient. Even during those last trying months he wrote as of old, dwelling lightly upon his sufferings. Money meant little to him, except for the good he could do with it. He acquired sufficient for his simple needs, and was content. Honors he never sought or cared for; the love of his fellow men sufficed. Upright in all his dealings, faithful to every trust, he inspired the best in men. It was his pride that in all his life he found no man who was not true to him. After a long, arduous and successful career as a mining engineer, of world-wide activity, his closing years were spent in serene retirement from professional duties. Not, however, in withdrawal from the world; life was still sweet to him, and there were still many kindnesses to be done. He died as he would have wished—in the arms of his devoted wife and daughters, and surrounded by his family. To them all who knew Mr. Riordan will extend their heartfelt sympathy.

San Francisco. GRANT H. SMITH.

MARKET AND FINANCIAL NEWS

Manipulation of Utah Lead Stock Blemishes Record of Salt Lake Exchange

Shares of the Company Drop From $7 to 50c. Following Listing and Speculation by Eastern Brokers

DESPITE efforts of a minority of the officials of the Salt Lake Stock and Mining Exchange, a stock listing on the exchange was granted the Utah Lead Company early in May. The stock was quoted at $1 at the start, but through manipulation by Eastern brokers, who had obtained control of it, this quotation was gradually forced up to $7 on July 21. After a three-day holiday, the exchange opened on July 25 with the stock selling at $5 a share. It dropped to $2.50 the same day, and at the close of trading on July 26 was quoted at 90c. The next day, July 27, the stock sold for 50c.

The State Securities Commission is involved to the extent that H. C. Hicks the director, in company with H. A. Rich, attorney for Utah Lead, visited the property and thereafter formally notified the Stock Exchange that the commission had no objection to listing. Significance is attached to the fact that the Utah Lead company was indebted to dealers in mining supplies, in Salt Lake City, to the extent of $25,000. In seeking listing the manager of Utah Lead agreed to pay these debts with the first funds received from the sale of stock. Typical of the extravagant boosting of the shares is the following from the July 28 issue of *Trend of the Market:*

"Of all the mining companies in Utah whose shares are low-priced and within reach of the average investor, we particularly favor Utah Lead. We have told our subscribers in these columns just what this company is planning in the way of a big development campaign of its properties and of what they consist, and how optimistic the Western newspapers are about the company. While, therefore, we have been particularly enthusiastic about this company ourselves from what we had previously been informed about it, the latest official information received this week makes us even more so, if this were possible.

"Shares of Utah Lead are actively traded on the Salt Lake Stock Exchange, and at this time of writing are selling at $7.00.

"We again advise our subscribers to lose no time in placing their commitments for shares of Utah Lead with their own broker. If they are not in a position to obtain this service they can have their orders executed by us through our own brokers. For this service we make no charge. They will only be charged the same commission as we are charged by our brokers."

Canadian Production of Miscellaneous Metals in 1927

STATISTICS on the production of antimony, bismuth, chromite, manganese, iron ore, mercury, molybdenum, tin and tungsten in Canada during 1927 as finally revised and reported by the Dominion Bureau of Statistics are as follows:

Antimony—Antimony ore occurs in the provinces of Nova Scotia, New Brunswick, and British Columbia, and in the Yukon Territory. It is also recovered in small quantities from the silver-lead-bismuth bullion obtained by smelters treating silver-cobalt ores. Toward the later part of 1927 it was reported that the antimony deposits of Lake George, New Brunswick, were being reopened and that ore was being bagged for shipment until an ore dressing plant employing the flotation process could be installed. The Consolidated Mining & Smelting Company, of Trail, B. C., obtains impure antimony as a byproduct in silver refining, but up to the present the purification of this product has not been undertaken.

Imports into Canada of metallic antimony or regulus amounted to 1,284,483 lb., valued at $143,446, and of antimony salts 52,709 lb., worth $10,766.

Bismuth — No metallic bismuth is made in Canada, but in the treatment of silver-cobalt ores by the smelter of the Deloro Smelting & Refining Company small quantities of bismuth are accumulated in a bullion with lead and silver. Bismuth contained in such bullion exported to the United States in 1927 amounted to 2,072 lb., valued at $1,003.

Chromite—Chromite occurs in British Columbia and in Quebec. There has been no production since 1923.

Manganese—No production was reported for 1927. Deposits of manganese occur in the provinces of Nova Scotia, New Brunswick, and British Columbia.

Iron Ore — Iron ore production amounted to 2,029 tons of titanium iron ore, valued at $8,980, which was exported from the province of Quebec to the United States. In 1926 the Manitou Iron Mining Company shipped 200 tons of ilmenite, valued at $600, to England for experimental purposes.

Shipments of iron ore from the Wabana mines, in Newfoundland, though not included in the mineral production of Canada, are of interest because of the tonnage shipped to Nova Scotia. During 1927 shipments from Wabana mines totaled 1,495,680 tons, valued at $2,478,663. Of this amount 946,569 tons, valued at $1,597,666, was exported to Europe; 68,354 tons, valued at $109,890, was exported to the United States, and 480,757 tons, valued at $771,107, was shipped to Canada.

Mercury—Prospecting and some development work was done in 1927 on cinnabar properties in the Bridge River area of the Lillooet mining division and in the Kamloops mining division of British Columbia. This ore of mercury also occurs in the same province, in the Alberni division of Vancouver Island.

Molybdenum—There was no production of molybdenum in 1927, but some development work was done during the year on a molybdenite property in the Abitibi district south of Amos, Quebec. The Moss mine, at Quyon, Quebec, ceased operations at the end of 1926.

Tin—Small amounts of tin are contained in the ores of the Sullivan mine of British Columbia, but up to the present the metal has not been recovered commercially.

Tungsten—Intensive prospecting was done during 1927 on a property in the Ovens district, of Nova Scotia. Surface trenching was carried on and a prospecting shaft was sunk to a depth of 30 ft. The surface trenching showed up a zone of slate, with stringers of quartz and scheelite. Scheelite also occurs in Waverley district, Halifax County, but no work was done on this deposit in 1927.

LUCKY JIM LEAD & ZINC COMPANY, operating in British Columbia, reports net operating loss of $6,896 during 1927, after deducting allowances for depreciation and depletion. There was produced during the year 8,388 tons of ore, which was shipped to the Consolidated M. & S. concentrator at Trail, B. C. A company concentration plant has been completed and placed in operation since the first of the year, and it is expected that the company's earnings will be materially increased in 1928.

Roosevelt Issues Statement on Zinc

RALPH M. ROOSEVELT, president of the American Zinc Institute, has issued the following unofficial statement, giving his personal views on the zinc market:

"As to the possible reasons for the recent stability of the slab zinc market, there may be as many opinions as there are interested individuals.

"At one time slab zinc was produced by comparatively small companies, operated by an individual responsible for both the production and sales of the zinc produced. There still are some small companies operating under these conditions, but the majority of slab zinc at the present time is produced by companies so large that it has become necessary to put the problem of production under one individual and the sales of the same under another.

"When the companies producing zinc were making money, no controversy existed between these two above-mentioned individuals. Recently, however, the smelters have had considerable difficulty showing a profit. Naturally, the operating department has tried to throw the responsibility on the sales department, and the sales department has tried to throw it on the operating department. The result has been that some companies have found it advisable to establish what might be called an umpire between these two departments. In one case I have in mind, this umpire is the daily metal quotation of the *American Metal Market*. The plant sells its slab zinc to the sales department on this quotation, and the sales department makes a profit or loss in accordance with the amount it realizes for its zinc over or under this above-mentioned quotation. This system forces the sales department to refrain from speculating on the market. It also prevents the sales department from selling 'futures' on a rising market, which is just the phenomenon which has been exhibited on the recent rise. Such a system also forces the sales department to attempt to get for its zinc at least the price at which it buys it from the production department.

"On the other hand, it was not so long ago that a consumer coming into the market for as much as 500 tons of zinc would have to pay a premium unless he gave the order to a broker to split up in small lots, thus concealing the fact that there was any considerable inquiry. At the present time I believe a zinc consumer can request prices for any quantity he desires and know that his business will be handled in a business-like manner.

"Another thing which tends to stabilize the slab zinc market at the present time is an increasing tendency to sell to consumers, either directly or through brokers, but not to speculators. At one time, when the industry was controlled by smaller companies, the speculator played a very important part in the industry. In times of slack business he absorbed the production of the weaker companies, really acting in the capacity of a banker and furnishing a cushion to a falling market, the same as the short interests act on a declining stock market. When business revived and the slab zinc market went higher, the speculator unloaded and, perhaps, broke the market several times in the process of unloading. Today most of the companies in business are able to carry their own stocks in times of slack business, and, naturally, when business revives, they use much more care in unloading their surplus stocks than the speculator has done in the past. One large producing interest, which for years has been selling without regard to the hands in which the metal went, has, within the last few months, changed its policy and now sells only to consumers. The influence on the market of this change in policy may have been considerable.

"There is really no reason why the price of zinc should fluctuate more than the price of similar metals."

Imports and Exports of Ores and Metals in June, 1927 and 1928

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

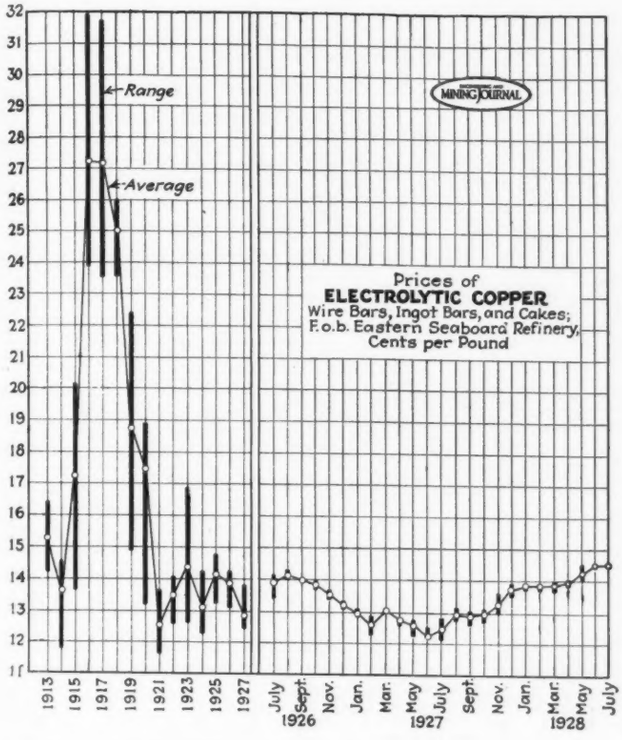
Imports

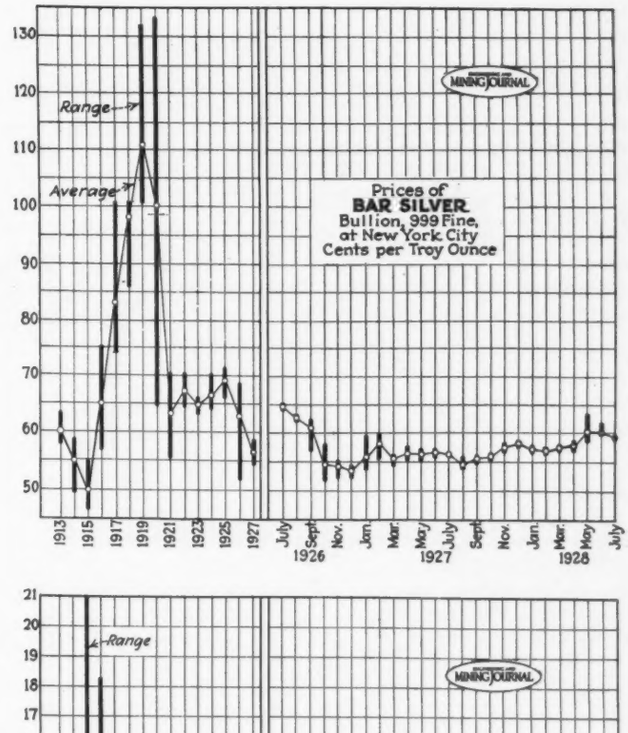
	June 1927	June 1928
Antimony		
Ore, Gross weight	372,164	576,186
Ore, Antimony content	183,924	286,524
Liquated regulus or metal	2,279,715	2,317,786
Copper		
Ores, copper content	6,324,120	8,851,800
Concentrates, copper content	7,078,534	2,833,830
Regulus, coarse metal, cement copper	40,520	331.104
Imported from		
Spain	342,039	538,241
Canada	4,041,248	4,126,076
Mexico	2.526,513	3,498,705
Cuba	4,540,000	.....
Chile	1,764,927	3,643,619
Peru	.....	79,599
Other countries	228,447	130,494
Unrefined black converter copper in pigs, bars and other forms	45,659,050	46,265,609
Refined copper	6,135,465	5,498,542
Old and clippings for remanufacture	736,322	859,212
Composition metal, copper chief value	.....	17,713
Brass, old, for remanufacture	564,679	1,289,450
Lead		
Ore and matte, lead content	7,916,304	6,705,160
Bullion or base bullion	27,540,081	21,181,020
Pigs and bars	17,735	1,118,343
Babbitt, solder and other forms, lead content	129,797	43,402
Type metal, antimonial lead, Gross weight	3,893	1,231,934
Type metal, antimonial lead, Lead content	3,114	959,283
Manganese, tons		
Cuba, manganese content	.....	.....
Other countries, manganese content	36,851	12,650
Pyrites, tons	15,552	35,351
Tin		
Ore, tons	10	5
Bars, blocks, pigs	11,512,349	11,312,472
Imported from		
Netherlands	2,249,232	1,175,925
United Kingdom	3,789,862	1,387,092
British Malaya	4,952,511	7,624,329
Hongkong	246,880	67,219
Australia	112,000	318,080
Other countries	161,864	739,827
Zinc		
Ore, zinc content, Free, less than 10 per cent zinc	250	2,850
Ore, zinc content, Dutiable	4,145,655	221,000
Blocks, pigs and old	.....	.....

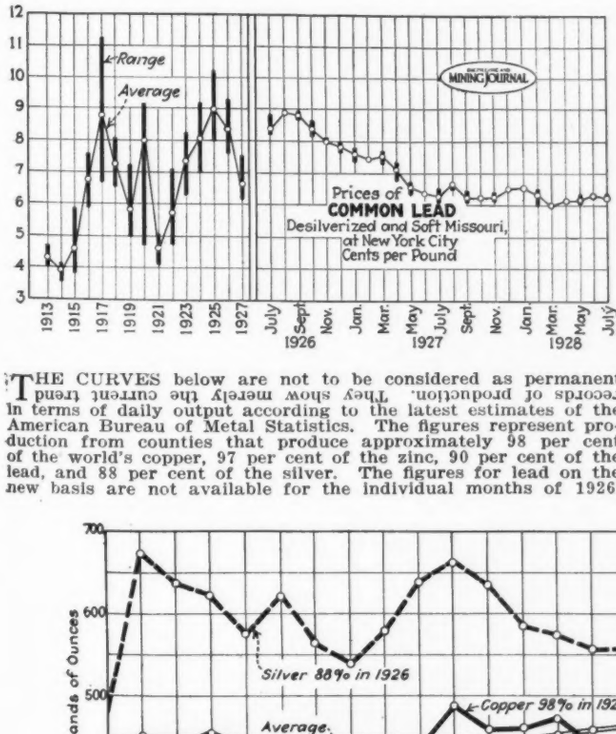
Exports

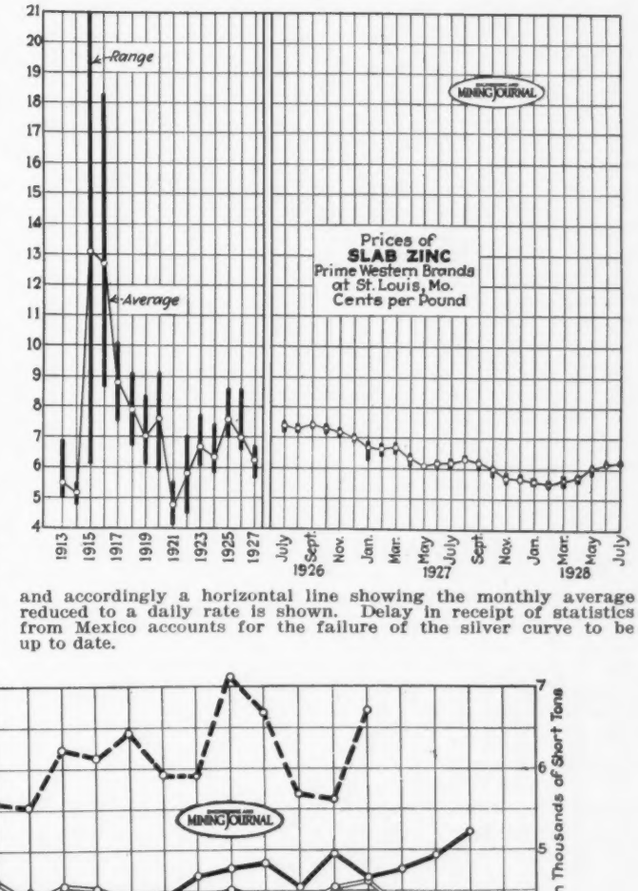
	June 1927	June 1928
Copper		
Ores, composition, concentrates, unrefined	214,278	60,026
Refined copper in ingots and other forms	74,438,716	87,072,752
Exported to		
Belgium	6,830,307	7,264,123
France	7,739,983	15,896,566
Germany	25,457,062	20,298,790
Italy	5,299,570	8,909,638
Netherlands	7,668,366	6,078,970
Spain	442,001	55,847
Sweden	2,210,467	3,691,279
United Kingdom	13,871,736	13,165,967
Other Europe	369,982	774,049
Canada	1,153,932	4,165,625
British India	.....	113,360
China, Hongkong, Kwantung	739,243	2,329,600
Japan	2,322,441	4,163,290
Other countries	333,626	165,648
Old and scrap	3,771,363	5,071,175
Pipes and tubes	260,402	315,321
Plates and sheets	748,218	465,010
Rods	5,673,686	6,500,941
Insulated copper wire and cable	1,700,205	1,981,746
Lead		
In pigs, bars and other forms		
From domestic ore	270,332	3,524,168
From foreign ore	24,142,864	13,051,738
Exported to		
Belgium	560,153	.....
France	778,704	392,148
Germany	12,290,316	4,627,132
Netherlands	616,163	504,111
Sweden	1,311,228	1,008,257
United Kingdom	2,576,957	5,489,510
Other Europe	560,159	728,269
Brazil	515,359	224,005
Other South America	988,409	13,887
China, Hongkong, Kwantung	560,715	114,205
Japan	3,586,066	3,427,579
Other countries	68,967	46,803
Other lead manufactures	392,268	872,255
Zinc		
Ores and concentrates, tons	3,200	.....
Dross	815,901	536,984
Cast in slabs, blocks and pigs	11,445,672	3,418,615
Exported to		
Belgium	257,671	56,046
France	1,198,489	727,991
Germany	663,485	336,055
Italy	918,493	224,047
Netherlands	152,886	85,557
United Kingdom	6,296,407	129,224
Other Europe	67,252	89,677
Argentina	896,434	2,311
Japan	896,066	1,605,763
Other countries	98,489	161,974
Sheets, strips, other forms	629,023	667,974
Dust	140,810	130,500
Other zinc manufactures	109,002	221,045

Metal Price Curves

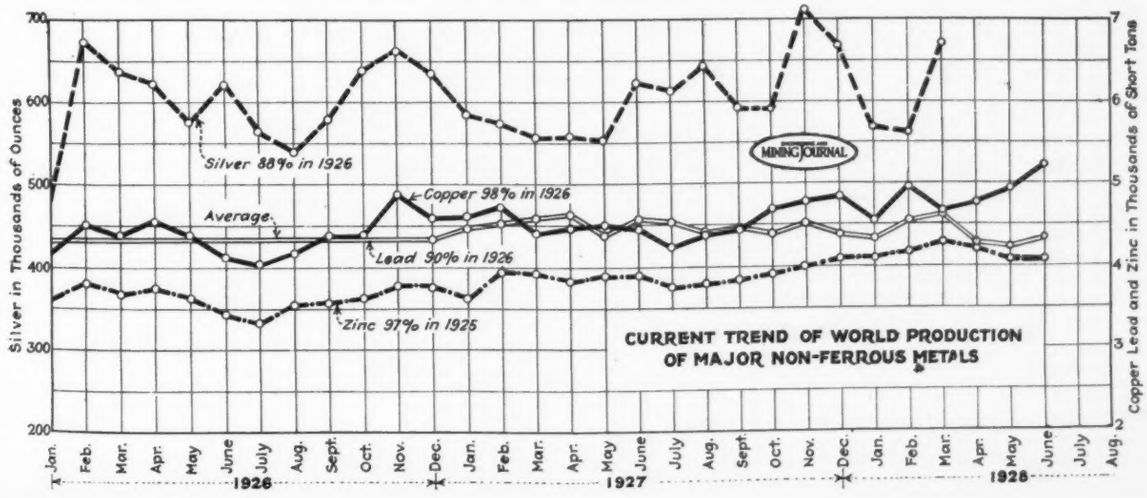

Range
Average
Prices of
ELECTROLYTIC COPPER
Wire Bars, Ingot Bars, and Cakes;
F.o.b. Eastern Seaboard Refinery,
Cents per Pound
MINING JOURNAL
1913 1915 1917 1919 1921 1923 1925 1927
July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July
1926 1927 1928







THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from counties that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


Silver 88% in 1926
Copper 98% in 1926
Average
Lead 90% in 1926
Zinc 97% in 1925
CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
MINING JOURNAL
Silver in Thousands of Ounces
Copper Lead and Zinc in Thousands of Short Tons
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug.
1926 1927 1928

Review of Current Statistics

By Homar L. Johnson
Assistant Editor

ENGINEERING AND MINING JOURNAL'S Weighted Index of Non-Ferrous Metal Prices failed to hold its position above the 100 level in July that it attained temporarily in June. Average prices for silver, lead, and tin were lower in July. Zinc advanced slightly, but insufficiently to offset any one of the three declines. Copper, aluminum, and nickel were unchanged. The net result was a decline in the Index Number, as shown in the accompanying table and represented on the chart at the top of page 237. At the time of writing, Aug. 8, prices for copper, aluminum, and nickel are unchanged from the July averages; lead and silver are slightly lower; and tin and zinc are somewhat higher.

A study of the latest statistical releases reveals that copper production for June established a new high record for all time. Daily rate of world copper production has advanced steadily since March, though total stocks of blister and refined have declined some 19,000 tons during that period. A further advance in the rate of production may be recorded in July, although the effect of the hot weather and the Fourth of July lay-offs on productive operations of some of the Southwestern companies must be considered. Logical reasoning suggests that the production curve will soon begin to flatten out, if not to descend, after the somewhat conspicuous advances of the last three months. Export shipments for the first six months of 1928 averaged 7,750 tons per month more than shipments for the corresponding period in 1927, which is a potent factor in the present strong position of copper. Domestic deliveries for June totaled 81,436 tons, another record. An interesting feature in the current trend of world metal production is shown by a glance at the chart at the bottom of page 235. Up to September, 1927, it will be observed that world production rates of copper and of lead have shown repeated monthly variations, with first one and then the other metal setting the pace in monthly production rates; since the aforementioned date, however, copper production has been consistently greater than lead; for June, the last month recorded, the difference amounted to 846 tons per day, or 19 per cent. Gross lead production of United States mines showed a decline in June, although the daily average figure registers a slight advance. Production of United States and Mexican smelters increased in larger proportion. United States imports of lead thus far in 1928 have been below the 1927 average consistently, a factor of some significance in analyzing price and production trends. Total stocks of lead were higher by nearly 3,000 tons at the end of June, after showing a decrease of some 2,000 tons in May.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54

	1926	1927	1928
December	102.31	98.30	——
January	112.66	100.46	97.54
February	111.91	100.01	96.73
March	108.95	100.84	96.22
April	105.93	98.63	97.14
May	105.43	96.41	99.05
June	106.68	95.55	100.16
July	109.08	95.42	99.69

June zinc statistics were the most favorable in recent months. Not only was the rate of domestic production reduced again, for the third consecutive month, but domestic deliveries recorded their second consecutive monthly advance, and accumulation of stocks was halted after proceeding steadily upward since February. Price of slab zinc continued firm throughout July, and the ability of the strong unofficial galvanizers and consumers' organization to batter the price of zinc about, more or less at will, appears lacking of late.

Stock-exchange prices were by no means bullish in July, and the fact that two of *Engineering and Mining Journal's* three share indices of metal mining company common stocks advanced is indicative of the relatively favorable position of many mining shares on the various stock exchanges. The advance in the Index Number for the Seven Mining-Smelting-Manufacturing Companies was featured by the appreciation in value of American Smelting & Refining Company's common-share quotations to above $200 per share. International Nickel, New Jersey Zinc, and American Metal also contributed to the advance.

Share quotations of the copper-group companies reversed their behavior recorded in June, when but one of the fourteen companies advanced, by reporting nine advances, with one unchanged and only four declines in July. The net result is a four-point advance in the Index Number, to 144.2. Kennecott accounted largely for the rise in this Index Number. Appreciation in value of share quotations for Nevada Consolidated, United Verde Extension, New Cornelia, Old Dominion, and Quincy contributed to lesser extent from a weighted standpoint. Old Dominion's advance was noteworthy, however, ascending from $12 to $15⅝ per share during the period under review. Quincy likewise registered a sharp advance for the month—from $31.50 to $39 per share. Small declines were recorded by Calumet & Arizona, Inspiration, Calumet & Hecla, and Miami.

The Index of Thirteen Miscellaneous Mining Companies was less fortunate than the smelting or the copper group. Small advances by Hecla, Homestake, and Silver King Coalition were of little consequence among the declines registered by Hollinger, St. Joe Lead, Cerro de Pasco, Lake Shore, Howe Sound, Premier Gold, Cresson Consolidated, and Utah-Apex. Hollinger share quotations dropped below $11 per share in a continuation of the downward reaction of this stock which has extended over the last seven months. *Engineering and Mining Journal's* Index of Non-Metallic Mineral Prices advanced fractionally as a result of the continued improvement in the price of gravel fluorspar, 85-5 grade. Prices for all other products were unchanged from June.

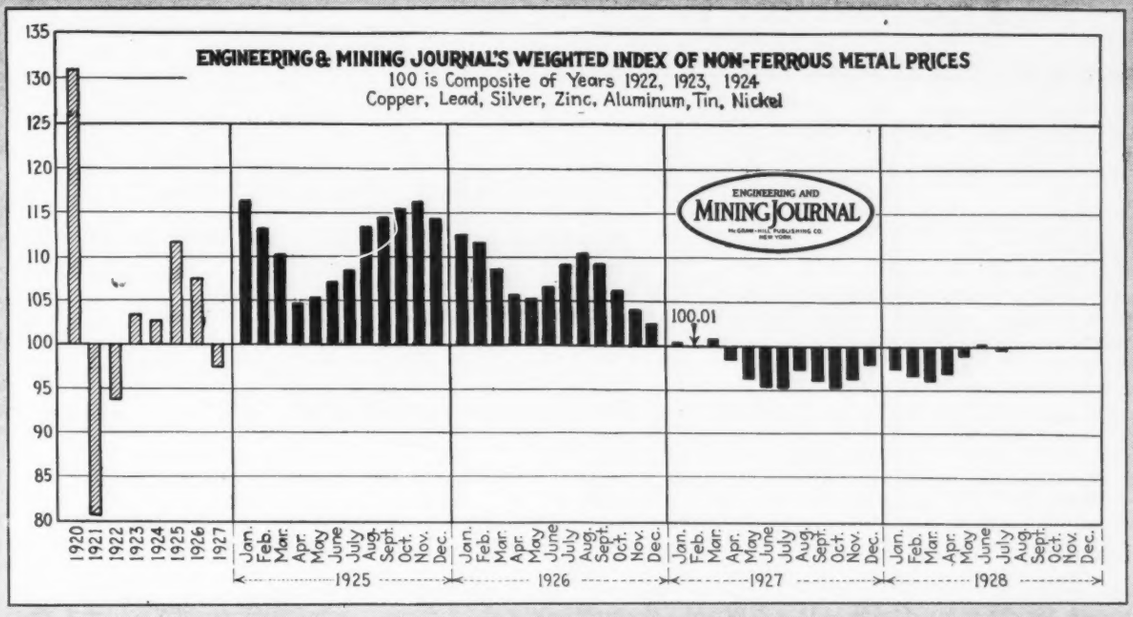
Current Statistics of Production and Stocks of Copper, Lead and Zinc

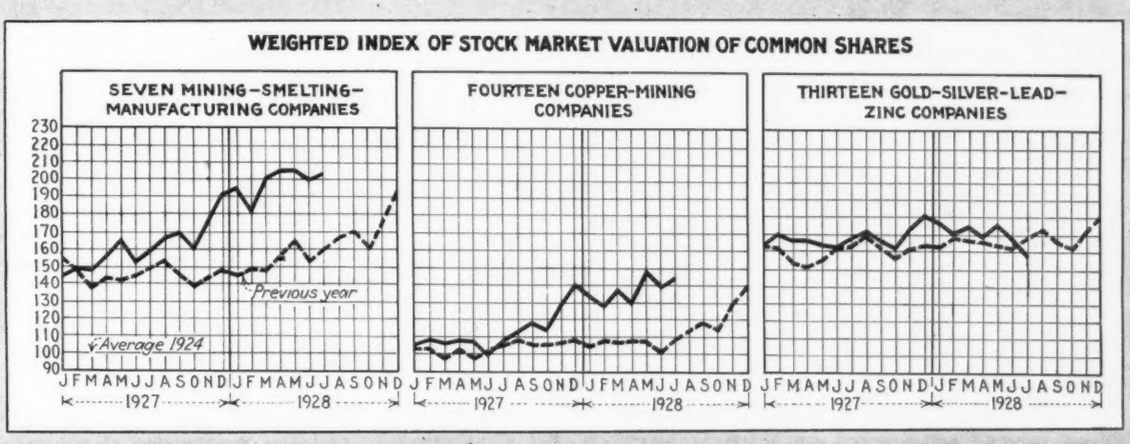
Data from American Bureau of Metal Statistics

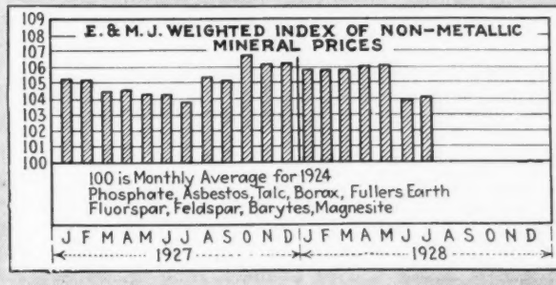
Figures Represent Short Tons

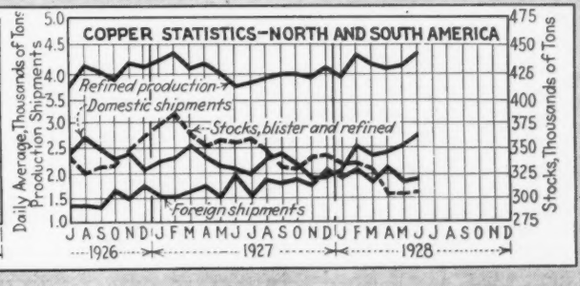
	1927		1928		
	Average	June	April	May	June
COPPER—North and South America					
Production, refined, daily average	4,045	3,774	4,094	4,169	4,367
Domestic shipments	68,737	63,465	72,234	79,103	81,436
Foreign shipments	53,489	61,487	64,989	56,738	57,067
Stocks, blister and refined	351,611	354,183	308,285	308,043	310,297
LEAD—United States and Mexico					
Production, smelter, daily average	2,513	2,533	2,288	2,345	2,470
Production, U. S. mines, daily average	1,798	1,769	1,671	1,661	1,710
Imports into U. S. A.	13,451	17,737	10,314	12,439	.....
Stocks, smelter and refinery	156,878	170,287	161,207	159,375	162,274
ZINC—United States					
Production, daily average	1,681	1,657	1,783	1,723	1,694
Domestic deliveries	45,811	43,122	46,517	49,818	49,780
Exports, slab zinc	3,468	5,275	2,620	2,148	.....
Exports, ores and dross	4,424	3,992	155	361	.....
Stocks	37,602	43,858	44,759	45,225	44,468
World Production Rate (Daily average)					
Copper	4,543	4,475	4,781	4,949	5,221
Lead	4,514	4,585	4,339	4,247	4,375
Zinc	3,910	3,884	4,212	4,112	4,129

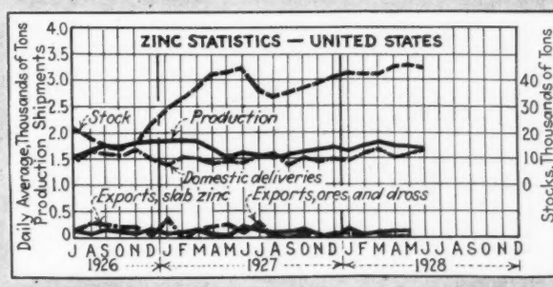
E.&M.J. Statistics of the Mining Industries

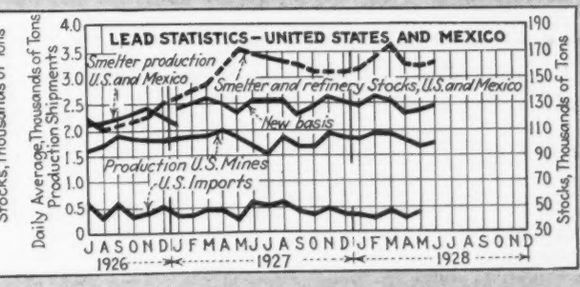





E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth
Fluorspar, Feldspar, Barytes, Magnesite
1927
1928







The Market Report

Metal Markets Continue Quiet But Prices Are Firm

New York, Aug. 8, 1928.—Though there has been no pronounced activity in the non-ferrous metal market during the week ending today, business has been by no means non-existent, and prices are firm. Sales of copper in the aggregate were only a little below average, and the same statement applies to lead. Zinc, on the other hand, after an exceptionally large turnover in the preceding week, was dull. Prices which prevailed with very little variation are 14.75c., Connecticut, for copper; 6.25c. for St. Louis zinc; and 6.20c. and 6c. for lead in New York and St. Louis, respectively. Tin was quite firm today.

Daily Prices of Metals

Aug.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
2	14.525	47.75	6.20	6.00	6.25
3	14.50@14.55	47.75	6.20	6.00	6.25
4	14.525	47.875	6.20	6.00	6.25
6	14.525	48.00	6.20	6.00	6.25
7	14.525	47.875	6.20	6.00	6.25
8	14.525	48.25	6.20	6.00	6.25
	14.525	47.917	6.200	6.000	6.250

Average prices for calendar week ending August 4, 1928, are: Copper, 14.527; Straits tin, 47.854; N. Y. lead, 6.200; St. Louis lead, 6.000; zinc, 6.225; and silver, 59.125.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
2	62 3/8	62 7/8	68 3/4	214 1/2	213 1/4	21	21 5/16	24 9/16	24 7/8
3	62 1/2	62 15/16	68 3/4	213 1/4	212	21 1/16	21 3/8	24 11/16	24 15/16
6	Holiday	....	....	....	....	....	....	....	....
7	62 5/8	63	68 3/4	213 3/8	211 7/8	21 1/16	21 3/8	24 5/8	24 7/8
8	62 3/8	62 13/16	68 3/4	213 3/8	211 7/8	21 1/16	21 5/16	24 1/2	24 3/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
2	4.85 1/4	59 1/4	27 1/4	84s11 1/2d	6	4.85 1/8	58 3/4	Holiday	.....
3	4.85 1/8	58 7/8	27 1/8	84s11 1/2d	7	4.85 1/16	58 3/4	27 1/8	84s11 1/2d
4	4.85	58 3/4	27 1/16	.....	8	4.85 1/16	59	27 3/16	84s11 1/2d
					Avg.		58.896		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Silver has been quiet, though the tone of the market has improved in the last day or two. Antimony and quicksilver are each stronger. Quicksilver has advanced about $3 a flask as a consequence of a sharp jump in the European market. Speculative manipulation and the prospect that foreign producers may artificially restrict output are assigned as reasons for the advance in London.

Good Buying of September Copper

Except for a few scattering transactions, most of the copper sold during the week was for September delivery. At the same time it is believed that not more than half of the September requirements of domestic consumers have been provided for. Even a smaller proportion of the needs of foreign buyers for September has been met. Brass makers have predominated among the domestic buyers, and indications are that orders on the books of fabricators are up to expectations. Most of the sales were for Connecticut delivery at 14 3/4c. In addition, one or two good sales for "Middle West" delivery were made at 14 7/8c. and a corresponding quantity for delivery in the immediate vicinity of refineries was sold at slight concessions. The foreign price continues at 15c. c.i.f. usual European destinations.

Moderate Activity in Lead

Little change is to be reported in the lead situation. Sales have been about twice as large as last week, but not on the scale of the two weeks before that. Some sellers did a fairly good business all week, but others report a marked falling off in the demand since last Friday. Cable business seems to have picked up appreciably, a fair tonnage also being taken by brass, blue-lead, pipe, and paint manufacturers, but sales to battery makers continue to be infrequent. Most of the inquiry is for prompt or August shipment, in carload quantities, but at least three sales, totaling a little over 1,000 tons, were booked for September.

Prices have held steady at 6.20c., New York basis, for desilverized lead, which is also the contract price of the American Smelting & Refining Company. One of the leading sellers is practically out of the market for chemical lead, but the other has booked a fair business from day to day at 6c., St. Louis. In the last two or three days, one of the small producers is reported to have been willing to sell at 5.975c., but so far as we have been able to learn no lead was actually sold at this level, whereas business *was* placed by others at 6c. The foreign demand for lead has been quiet and steady, London quotations having advanced slightly to £21 1s. 3d.

Corroding grades of lead in the domestic market continue to be quoted at $2 to $3 per ton premium.

Zinc Particularly Dull

The week ended last Wednesday was marked by unusual activity in the zinc market; consequently, it was not surprising that it was followed by a period of extreme dullness. The absence of buying may have been caused in part by the firm attitude taken by sellers, who declined to accept less than 6.25c. for their metal, except in one or two instances in which spot lots were sold at 6.22½c. Statistics compiled by the American Zinc Institute indicate that galvanizers are bought for only a brief period in advance, and producers feel that if they hold off they will get their price. Incidentally, they point out that the statistics of current sales are essentially the same data that the galvanizers themselves have been collecting and distributing for their own information for several years. High-grade zinc is nominal at 7.50c. for spot lots in New York.

Fair Business in Prompt Tin

Consumers have taken a moderate amount of tin for near-by delivery during the week, but little interest has been exhibited for forward shipment, the price of which ranges down to ⅞ to 1c. discount from spot, for November-December. Apparently production is exceeding consumption to some extent, and if this continues there will be difficulty in maintaining present prices.

Silver 59c. on Aug. 8

The silver market for the last week has been without feature. Prices eased off after Aug. 2, but a better demand from the Orient caused some recovery today. The close is steady.

Mexican Dollars (Old Mexican pesos): Aug. 2d, 44⅞c.; 3d, 44½c.; 4th, 5th, and 6th, 44⅜c.; 8th, 44⅝c.

Foreign Exchanges Quiet

Foreign exchanges are virtually unchanged, with the exception of the Spanish peseta, which has advanced on rumors of stabilization on a gold basis. Closing cable quotations on Tuesday, Aug. 7, were as follows: Francs, 3.90¾c.; lire, 5.23¼c.; and marks, 23.84¾c. Canadian dollars, ¾ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York; Chinese brands, near-by, 10c., futures, 10¼c. Cookson's "C" grade, spot, 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM—Per lb., New York: 70@75c., according to quantity.

IRIDIUM—Per oz., $280@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $42@$47. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $75.50@$76.50 asked. Nominal.

QUICKSILVER — Per 76-lb. flask, $123@$125, depending on quantity. Some improvement in consumer buying. Market highly stimulated by reported action of strong European interests in buying up excess stocks, presumably for speculative purposes. San Francisco wires $122.33.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Aug. 4.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn: 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the Aug. 4 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.75@$11, Western scheelite, $10.60@$11.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Aug. 4 issue.

Poor Classification Adds to Penalties on Joplin Concentrate

Joplin, Mo., Aug. 4, 1928

Blende		Per Ton
High		$41.50
Premium blende, basis 60 per cent zinc	$40.00@	41.00
Prime Western, basis 60 per cent zinc		40.00
Slimes and fines, 60 per cent zinc	37.00@	39.00
Average settling price, all zinc		39.52
Galena		
High		$82.10
Basis 80 per cent lead		80.00
Average settling price, all lead		81.71

Shipments for the week: Blende, 11,582; lead, 1,470 tons. Value, all ores the week, $577,850.

Heavy and frequent rains are causing a more expensive drainage problem, but have not retarded the general output, which continues equal to the demand. Buyers are tightening lines on zinc ore classification and a few sellers find slow sale for their product because they decline to make a separation of coarse, table, and flotation concentrates. Penalties for failure to classify the product are being increased. All desirable zinc ore is in steady demand at unchanged prices.

Platteville, Wis., Aug. 4, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$81.00

Shipments for the week: Blende, 624 tons; lead, none. Shipments for the year: Blende, 22,058 tons; lead 1,245 tons. Shipments for the week to separating plants, 1,707 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Aug. 4 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market firm.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Aug. 4 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the Aug. 4 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the Aug. 4 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Aug. 4.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $15.75@$16; No. 2 foundry, $16.50.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.70@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $3.75@$4.50. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended August 4, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	67⅞	65½	66	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	4½	4	4⅛	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz.	New York	98½	93½	94½	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	23½	22⅞	23⅛	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	77⅛	74⅛	76⅜	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	45½	44⅛	44⅜	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	11	10⅛	11		
Copper Range	Boston	18⅜	17½	17½	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*33	*30	*30		
East Butte	Boston	3½	2½	2½	Dec., 1919	0.50
Granby Consol	New York	54½	53½	53⅝	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	103½	97⅛	99⅛	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	58⅛	56	57	Je.30, Jl.16, Q	1.00
Inspiration Consol	New York	21⅝	21⅛	21⅛	Apr. 1927 Q	0.25
Isle Royale	Boston	19⅜	18	18	Au.31, Se.15 SAX	0.75
Kennecott	New York	95¼	93⅛	94	Jl. 1, Jl. 2 Q	1.25
Magma Copper	New York	51⅛	50⅛	50⅛	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	20⅜	19½	19⅛	Au.1, Au.15, Q	0.37½
Mohawk	Boston	58½	56	56	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*19½	*17½	*18⅛		
Mother Lode Coal	New York	2⅜	2½	2⅛	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	22⅜	22⅛	22⅜	Je.15, Je.30 Q	0.375
New Cornelia	Boston	28⅛	27⅛	27⅛	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	59½	52⅜	58		
North Butte	Boston	3⅜	3⅛	3⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*77	*68	*69	Sept., 1926	0.03
Old Dominion	Boston	15⅛	14⅛	14⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	133½	133	133⅛	Je.25, Jl.22 Q	2.00
Quincy	Boston	39	37⅝	37⅝	March, 1920	1.00
St. Mary's Min. Ld	Boston	28	27⅛	27⅛	Ap.1928 A	2.00
Seneca Copper	New York	2⅜	2⅜	2⅛		
Shattuck-Denn	N. Y. Curb	15⅛	15	15⅛		
Tenn. C. & C.	New York	14⅛	13⅜	14⅛	My.29, Je.15,Q	0.12½
United Verde Ex	N. Y. Curb	16⅛	14⅛	14⅛	July 6, Q	0.50
Utah Copper	New York	162	162	162	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1½	1 5/16	1½	Dec., 1917	0.30
Walker Mining	Salt Lake	1.35	1.25	1.25		
NICKEL-COPPER						
Internat. Nickel	New York	103	94⅛	101⅛	Je.14, Je.30 Q	0.50
Internat. Nickel pfd.	New York	116	116	116	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*2⅜	*2⅛	*2⅛	June, 1927	0.005
National Lead	New York	122	122	122	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	144¼	144¼	144½	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York			122	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	41⅛	39⅜	39⅜	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	27	25⅛	26⅛	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	87	84½	84⅛	Nov., 1920	1.50
Butte C. & Z.	New York	7⅜	7	7⅛	Dc., 1926	0.50
Butte & Superior	New York	11⅛	9	9	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	2⅞	2⅜	2⅜	Dc., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	13	12⅛	13	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	18	16⅝	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati			100	July 15 Q	1.50
New Jersey Zn	N. Y. Curb	224½	224	224½	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	17.75	16.75	17.75		
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*30	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4	3⅜	3⅜		
Ankerite	Toronto			*40		
Barry-Hollinger	Toronto	*49	*34	*40		
Central Manitoba	Toronto	*95	*80½	*95		
Cresson Consol. G	N. Y. Curb	1 1/16	1	1	Je.30, Jl.10 Q	0.10
Dome Mines	New York	8½	8	8	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.68⅜	†1.67⅜		My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*8½	*7⅛	*8		
Hollinger Consol	Toronto	10.90	9.25	9.40	Jl.25, Au.11 FW	0.10
Homestake Mining	New York			74	Jl.20, Jl.25 M	0.50
Kirkland Lake	Toronto	1.64	1.52	1.55		
Lake Shore	Toronto	21.75	21.00	21.00	Je.1, Je.15 QX	0.20
McIntyre Porcupine	New York	22½	22½	22½	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*21	†*20		Ap., 1927	0.02
Rand Mines	New York			39½	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	2.20	2.00	2.20		
Teck-Hughes	Toronto	9.52	9.33	9.40	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*43	*40	*41	Dec., 1926	0.02
Tough-Oakes	Toronto	*24	*16	*20		
Vipond Cons	Toronto	*47	*44	*44	April, 1927	0.03
Wright-Hargreaves	Toronto	3.25	3.05	3.25	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb			18½		
Con. Cortes	N. Y. Curb	*22	*21	*22		
Dolores Esperanza	N. Y. Curb	1	1	1	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Je.14, Jl.3 Q	0.06
Tonopah Belmont	N. Y. Curb			1	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb			*13	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	5	4⅛	4⅛	Mar.31,Ap.21 SA	0.07½
West End Consol	N. Y. Curb			*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	*75	*68	*74	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.00	*87	1.00	May, 1920	0.03
Castle-Trethewey	Toronto	*49½	*47	*49		
Coniagas	Toronto	4.80	4.80	4.80	May, 1924	0.12½
Keeley	Toronto	*50	*50	*50	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto			*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.46	3.20	3.27	My.20, Je.13 SA	0.12½
Nipissing	N. Y. Curb	3⅜	3⅛	3⅛	Je.30, Jl.20Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3¼	3	3⅛	Ap., 1927	0.12½
Bingham Mines	Boston	43⅛	43⅛	43⅛	Jl.31, Au.4 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	132	132	132	Jl.31, Au.4 MX	0.75
Cardiff M. & M.	Salt Lake	*60	*60	*60	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.25	4.02½	4.02½	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*34	*30	*34		
Erupcion	Boston Curb			*28	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.02½	1.82½	1.97½		
Federal M. & S.	New York			125	Je., 1927	10.00
Federal M. & S. pfd.	New York			98	Au.15, Se.15 Q	1.75
Hecla Mining	N. Y. Curb	15⅛	14⅞	15	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*12⅜	*11	*12½		
Iron King Mining	Salt Lake	*85	*81	*81		
Keystone Mining	Salt Lake	*26	*26	*26	Fe., 1926	0.07½
Lucky Jim	Spokane	*31½	*31	*31		
Lucky Tiger-Com	Kansas City	†7.55	†7.40		Au.7,Au.20 M	0.05
Mammoth Mining	Salt Lake	†1.55	†1.42		De., 1926	0.25
North Lily	Salt Lake	7.95	7.75	7.95		
Park Utah	New York	11⅞	10⅛	10⅜	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	†1.60	†1.50		Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*47½	*29	*29	June 15 Q	0.03
Silver King Coal	Salt Lake	12.50	12.25	12.50	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*11	*8⅛	*10	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*94	*85	*90		
Sunshine M. Co.	Spokane	1.38	1.33	1.33	June 20, K	0.02
Tamarack-Custer	Spokane	*47⅜	*45	*45½	Sept., 1924	0.25
Tintic Standard	Salt Lake	14	13½	14	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	4	3⅞	4	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	57⅜	55⅜	56⅝	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	115	103½	106	Jl.14, Jl.25 Q	1.00
Colorado F & I, pfd.	New York	64½	60½	61⅛	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	22⅜	20½	21	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	58⅜	56	57½	My. 15, Je.1 Q	0.62½
Republic I. & S.	New York	57½	56	56⅜	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd.	New York	105½	105½	105½	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I.	New York			111	Je.9, Je.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York			115⅜	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	145¼	139½	140⅜	Au.30, Se.29 Q	1.75
U. S. Steel, pfd.	New York	141⅜	141	141	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C.	New York			14½	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	50	50	50	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			23½	Ju.16, Ju.26 K	0.97
So. Am. G. & P.	N. Y. Curb	3	3	3		
Alum. Co. of Amer.	N. Y. Curb	148	133	146⅜		
Alum. Co. of Amer. pf.	N. Y. Curb	107½	107½	107½	Je. 15, Jl. 1 Q	1.50
Vanadium Corp.	New York	76½	71½	73	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	34⅛	32	33	April, 1928	4s.
ASBESTOS						
Asbestos Corp.	Montreal	29¾	26½	29	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	90¼	89¾	90	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	63⅛	57⅞	63	Jl.14,Au.1 QX	1.75
Texas Gulf	New York	70⅜	67⅞	69	Je.1, Je.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	49⅜	47⅛	48⅛	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	111	111	111	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York			125	My.15, Je.1	1.75
Amer. Sm. & Ref.	New York	205⅜	199⅜	200⅛	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	135¼	135	135	Au. 3, Se. 1 Q	1.75
Consol. M. & S.	Montreal	252	248½	250	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	162⅜	157	158	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M.	New York	47⅛	46⅛	47	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	53⅛	52⅛	53⅛	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED July 24, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35/—	35/—	35/—			
Alaska Treadwell ($25)	120/—	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	62/6	56/3	62/6	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/—	13/7½	13/9	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	5/7	5/—	5/6			
Camp Bird (2s)	3/7½	3/6	3/6	April, 1928	16¾ p.c.	
El Oro (£1)	4/3	3/9¾	4/1¾	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	9/9	9/6	9/6	July 1928	3¾ p.c.	
Mexican Corpn. (£1)	18/9	15/—	18/9			
Mexico Mines of El Oro (£1)	19/9	17/6	17/6	Dec., 1926	3¾ p.c.*	
Mond Nickel	171/10½	166/3	167/6	Aug., 1928	20 p.c.	
N'Changa Copper Mining	20/	18/9	18 9			
Oroville Dredging (£1)	3/9¾	3/9	3/9	Dec., 1923	3¾ p.c.	
Rhodesian Congo Border (£1)	34/4½	32/6	32/6			
St. John del Rey (£1)	12/3	11/3	11/6	April, 1928	7½ p.c.	
San Francisco Mines (10s)	27/3	26/4½	26/9	July 1928	12 p.c.	
Santa Gertrudis (£1)	15/1½	14/—	14/3	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	10/10½	9/9½	10/6	April, 1917	6¼ p.c.	
S. Amer. Copper (2s.)	2/4½	2/—	2/1½	Nov., 1917	75p.c.	
Tanganyika (£1)	56/3	53/9	54/4½	July 1928	5p.c.	
Union Miniere de Haut-Katanga (Brussels)	10,500	10,400	10,400	July, 1928	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.